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FINAL

RECORD OF DECISION

SITE 12
BARRACKS ROAD LANDFILL
(OPERABLE UNIT NOs. III, IV, AND V)

NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

MAY 1997

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LIST OF ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
ARAR	applicable or relevant and appropriate requirement
Baker	Baker Environmental, Inc.
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	code of Federal Regulations
COC	chemical of concern
COPC	contaminant of potential concern
CSF	cancer slope factor
DDD	Dichlorodiphenyldichloroethane
DoN	Department of the Navy
ECOC	ecological contaminant of concern
ER-M	Effects Range-Median
ER-L	Effects Range-Low
FFA	Federal Facility Agreement
FS	Feasibility Study
GW	groundwater
HI	hazard index
HQ	hazard quotient
IAS	Initial Assessment Study
ICR	incremental cancer risk
IR	Installation Restoration
MBI	macroinvertebrate biotic index
mg/Kg	milligrams per kilogram
Ig/Kg	micrograms per kilogram
Ig/dl	micrograms per deciliter
Ig/L	micrograms per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NPW	net present worth
O&M	operation and maintenance
OU	Operable Unit
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PRAP	Proposed Remedial Action Plan
QI	quotient index
RA	risk assessment
RAA	remedial action alternative
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RfD	reference dose
RI	Remedial Investigation
RL	remediation level
ROD	Record of Decision
RGO	Remediation Goal Objective

S	soil
SARA	Superfund Amendments and Reauthorization Act
SB	soil boring
SD	sediment
SSA	Site Screening Area
SVOC	semivolatile organic compound
SW	surface water
SWSL	surface water screening level
TAL	target analyte list
TBC	to-be-considered criterion
TCE	trichloroethene
TDI	total daily intake
TNB	trinitrobenzene
TNT	2,4,6-trinitrotoluene
TRV	toxicity reference value
TSCA	Toxic Substance Control Act
UBK	uptake biokinetic
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VADEQ	Virginia Department of Environmental Quality
VDHR	Virginia Department of Historic Resources
VOC	volatile organic compound
WPNSTA Yorktown	Naval Weapons Station Yorktown

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DECISION SUMMARY

1.0 INTRODUCTION

This Record of Decision (ROD) document presents the final remedial action selected for Site 12, the Barracks Road Landfill (Operable Unit [OU] Nos. III, IV, and V), at Naval Weapons Station Yorktown (WPNSTA Yorktown), Yorktown, Virginia. The environmental media at this site were investigated as part of a Remedial Investigation (RI), and remedial action alternatives (RAAs) were developed and evaluated as part of a Feasibility Study (FS). Based on the results of the RI and FS, preferred RAAs were identified in a Proposed Remedial Action Plan (PRAP) document. Then, the public was given the opportunity to comment on the RI, FS, and PRAP. Based on comments received during the public comment period, and any new information that became available in the interim, a final remedial action plan was selected for Site 12. This ROD document presents the final selected remedy along with a summary of the remedy selection process.

The Decision Summary of the ROD is organized into 11 main sections. Section 1.0 presents an introduction, and Section 2.0 presents the site name and location, and a brief description of the site layout. Section 3.0 presents a history of the site and previous investigations/enforcement activities conducted there. Section 4.0 highlights community participation events that have occurred during the development of this ROD. Section 5.0 describes the scope and role of the response action developed to address the site contamination, and Section 6.0 summarizes the nature and extent of this site contamination (i.e., the site characteristics). Section 7.0 summarizes the site risks as determined by human health and ecological risk assessments. Section 8.0 describes the RAAs developed for soil and groundwater, while Section 9.0 summarizes the comparative analysis of these alternatives. Finally, Section 10.0 presents the final remedy selected for Site 12, and Section 11.0 evaluates the selected remedy with respect to the statutory determinations.

2.0 SITE NAME, LOCATION, AND DESCRIPTION

2.1 Site Description

The Site 12 study area contains Site 12 proper and the surrounding study area which are located in the eastern portion of WPNSTA Yorktown (also referred to as the Station). The Station is a 10,624-acre installation located on the Virginia peninsula in York County, James City County, and the City of Newport News (Figure 2-1). Site 12 is one of several sites and site screening areas (SSAs)located within the Station The Site 12 study area encompasses 92 acres and is located near the Industrial Area of WPNSTA Yorktown (Figure 2-2). In general, the study area is bordered by Barracks Road to the west, and Ballard Creek and the Colonial National Historical Park to the east and south.

Site 12 proper contains three former disposal areas. One of the former disposal areas, designated as Area A, is located north of SSA 15 and northeast of the Industrial Area Building 4. Area A is partially wooded and covers approximately 4.4 acres. An incinerator building and a smoke stack are located within Area A. The incinerator building contains two incinerators which were formerly used to burn industrial and nonindustrial wastes. The ash from the incinerators was disposed in a topographic low area or ditch that leads to Ballard Creek and is located immediately southwest of the incinerator building. A stream channel flows through this ditch and into Ballard Creek. Another former disposal area, designated as Area B/C, is located east of Barracks Road and adjacent to the access road leading to the incinerator building. Area B/C covers approximately 1.6 acres. A portion of Area B/C is an open field. Other portions are wooded and contain steep slopes and ravines. The third former disposal area has been designated the Wood/Debris Disposal Area. this area is located east of Areas A and B/C and covers approximately 3.3 acres. The Wood/Debris Disposal Area was created when wood and miscellaneous construction debris were disposed of and pushed into a ravine toward Ballard Creek. The disposed material was then covered with soil. The Wood/Debris Disposal Area is an open field with visible debris protruding out along the backside of this area adjacent to Ballard Creek. A ditch with an intermittent stream channel is located adjacent to the

Wood/Debris Disposal Area.

As shown in Figure 2-2, SSA 15, the Abandoned Sewage Disposal Plant No. 1, is located within the expanded Site 12 study area. However, based on the Round Two RI results and investigations specific to SSA 15, this SSA does not appear to be a source of contamination to environmental media. As a result, no additional investigative efforts are proposed for SSA 15 (as well as Areas of Concern [AOCs] 5, 6, and 7) under the Installation Restoration (IR) Program.

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Review of historical aerial photographs revealed the presence of a former railroad spur that cut across Site 12 proper. The spur was connected to the existing railroad track in the Industrial Area, near Buildings 4 and 5. It appears as though the spur crossed Barracks Road and terminated in the general vicinity of the incinerator building at Area A. Information regarding the spur and when it was removed is not available. However, the historical aerial photographs indicate that the majority of the spur had been removed prior to October 1986.

The overall topography of the Site 12 study area is varied, but it generally slopes to the south-southeast from Barracks Road toward Ballard Creek. Relatively level, grass covered fields comprise portions of the northwestern quarter of Area A, the area northwest of the incinerator building (between Areas A and B/C), part of the Wood/Debris Disposal Area and a small area around SSA 15. The remainder of the Site 12 study area is predominantly wooded. The overall topography ranges from gently rolling to steep ravines.

As shown in Figure 2-2, several stream channels drain Site 12. The northernmost stream channel is located in the ditch adjacent to the northeast boundary of the Wood/Debris Disposal Area; another channel is located within the ditch bisecting Area A; while two additional channels converge and form one channel southwest of SSA 15. All of these channels drain into Ballard Creek which defines the southern boundary of the Site 12 study area and directs surface water northeast to the York River.

With respect to local hydrology, Site 12 is located downgradient of the Industrial Area (Buildings 3 through 6). Industrial Area operations have had an impact on the shallow groundwater that flows from the Industrial Area toward Site 12 and ultimately to Ballard Creek. Underground storage tanks (USTs) that formerly contained waste oil, solvents, and/or heating oil have been associated with Buildings 3 through 6. The integrity of these tanks may have been compromised. One of these tanks, UST 5.1, was located adjacent to the northern corner of Building 5, upgradient from Site 12. The UST was an asphalt-coated steel tank with a capacity of approximately 12,400 gallons. The tank had been used originally to store fuel oil; however, was later used to store waste oil. In December of 1993, the tank was closed and removed. Other USTs similar to UST 5.1 were present between Buildings 3 and 4. One of the USTs was removed in 1993, and another one remains in use supplying Number 5 fuel oil to the boiler in Building 3. The active UST has recently passed tightness testing and is not likely a source of contamination to the shallow groundwater.

2.2 Operable Units

A Comprehensive Environmental Response Compensation and Liability Act (CERCLA) remedial action is often divided into operable units or OUs. As defined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP)(40 Code of Federal Regulations [CFR] 300.5), "an Operable Unit means a discrete action that comprises an incremental step toward comprehensively addressing site problems. This discrete portion of a remedial response manages migration or eliminates or mitigates a release, threat of release, or pathway of exposure. The cleanup of a site can be divided into a number of operable units, depending on the complexity of the problems associated with the site. Operable units may address geographical portions of a site, specific site problems or initial phases of an action, or may consist of any set of actions performed over time or any actions that are concurrent but located in different parts of the site."

Site 12 was divided into three operable units: OU III which corresponds to soil at Area A of Site 12; OU IV which corresponds to soils at Areas B/C and the Wood/Debris Disposal Area; and OU V which corresponds to groundwater across the study area, and surface water and sediment in Ballard Creek. Groundwater, surface water, and sediment were combined into the same operable unit because shallow groundwater from Site 12 potentially recharges Ballard Creek. Thus, groundwater, surface water, and sediment are interrelated.

3.0 SITE HISTORY AND PREVIOUS INVESTIGATIONS/ENFORCEMENT ACTIVITIES

3.1 Site History

The former disposal areas at Site 12 were in operation from approximately 1925 to the mid-1960s. During this time, the disposal areas received an estimated 1,400 tons of waste. Wastes reported to have been disposed at the three disposal areas include refuse, scrap wood, piping, steel containers, and nitramine-contaminated packaging. It is likely that solvents were also disposed.

With respect to Area A, wastes were transported to the site by truck and railcar and open-burned prior to disposal. In addition, the two incinerators located at Area A were used to burn a variety of waste taken from ships coming from foreign ports. Ash from incineration activities was disposed on the hillside behind the incinerator building. The hillside trends toward the ditch which bisects Area A. Ash from wastes that were open-burned in the northern section of Area A were spread across the top of Area A toward the incinerator to the south. Scrap metal, charred wood and cloth, and glass have been observed in the ash.

The Wood/Debris Disposal Area was reportedly used for disposal of lumber (not matching specifications), wooden pallets and miscellaneous construction debris which are still presently visible on the backside of the area in the vicinity of Ballard Creek.

3.2 Previous Investigations

Previous investigations conducted at Site 12 include an Initial Assessment Study (IAS), two Confirmation Studies, a Focused Biological Sampling and Preliminary Risk Evaluation, a Round One RI, a Habitat Evaluation, a Background Constituent Study, a Round Two RI, and an FS. The following provides a brief description of these investigations.

3.2.1 Initial Assessment Study

An IAS was conducted at WPNSTA Yorktown in 1984. The purpose of the IAS was to identify and assess sites posing a potential threat to human health and/or the environment due to contamination from past operations. The study identified 15 sites at WPNSTA Yorktown, including Site 12, that were of sufficient potential threat to human health or the environment to warrant further investigations.

3.2.2 Confirmation Study

In 1986 and 1988, two rounds of sampling were conducted for a Confirmation Study at Site 12. The study was documented in two Confirmation Study reports and a third report titled the RI Interim Report. The results of this study recommended that further RI activities be conducted at Site 12.

3.2.3 Round One RI

The Round One RI for Site 12 was conducted in 1992. The field investigation included the collection of surface soil, subsurface soil, groundwater, surface water, and sediment samples at the locations identified in Figure 3-1. Contaminants were detected in all media sampled at the site. Several inorganic compounds (e.g., lead, cadmium, mercury, zinc) were detected in soil samples at concentrations exceeding site-specific background levels. Volatile organic compounds (VOCs) (e.g., trichloroethene [TCE]), and nitramine compounds (e.g., 2,4,6-trinitrotoluene [TNT]; 1,3,5-trinitrobenzene [1,3,5-trinitrobenzene [1,3,5-TNB]; and hexahydro-1,3,5-trinitro-1,3,5-triazine [RDX]) were detected in the groundwater samples. With respect to surface water samples, concentrations of several inorganic compounds (e.g., copper, mercury, and nickel) were detected above surface water criteria in filtered samples. Sediment samples contained levels of certain pesticides, polychlorinated biphenyls (PCBs), and inorganic compounds which exceeded the National Oceanic and Atmospheric Administration (NOAA) sediment quality values. In addition, several inorganic compounds, including beryllium, barium, cadmium, lead, manganese, mercury, silver, and zinc were detected in the sediment samples at concentrations exceeding site-specific background concentrations As a result of the Round One RI field investigation, the Wood/Debris Disposal Area was identified as a potential area of contamination. In addition, the Round One RI identified data gaps with respect to potential impacts to ecological receptors, and to the nature and extent of the contamination at Site 12. Therefore, the Round One RI recommended additional sampling for all environmental media at Site 12.

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3.2.4 Habitat Evaluation

A habitat evaluation was conducted in 1994 to address the aquatic habitats (stream areas) and the terrestrial habitats (land areas) at Site 12. With respect to the aquatic habitats, the study noted that Site 12 is located within the Ballard Creek watershed which is a freshwater tributary to the York River. In addition, wetlands were identified south of the incinerator building at Area A and along Ballard Creek north, east, and south of the site. Three types of general terrestrial habitats were identified including open fields, mature upland forest, and scrub-shrub/mixed deciduous forest edge with colonizing trees. A variety of birds, turtle eggs, and signs of deer, squirrels and groundhogs were observed.

3.2.5 Background Constituent Study

A Background Constituent Study was conducted for WPNSTA Yorktown in 1995. The main objective of this study was to provide detailed information on soil, groundwater, surface water, sediment, and biologic communities at areas within or near WPNSTA Yorktown that had potentially been affected by Station activities. The study is documented in a report titled, Summary of Background Constituent Concentrations and Characterization of Biotic Community from the York River Drainage Basin. The information obtained during the Background Study can be used to distinguish between site related and naturally occurring constituent concentrations.

3.2.6 Round Two RI

Conducted in 1994, the Round Two RI field activities included surface soil, subsurface soil, groundwater, surface water, sediment and biota sampling at the locations identified in Figures 3-2, 3-3, and 3-4. Analytical results of these sampling efforts are summarized later in Section 6.0 (Site Characteristics) of this ROD. During the Round Two RI, human health contaminants of potential concern (COPCs) and ecological contaminants of concern (ECOCs) were identified. Tables 3-1 and 3-2 present COPCs and ECOCs identified for Site 12. Baseline risk assessments (RAs) were conducted to evaluate the potential risks associated with these COPCs and ECOCs. The results of the RAs are summarized later in Section 7.0 of this ROD.

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TABLE 3-1

CHEMICALS OF POTENTIAL CONCERN (COPCs) PER MEDIA
SITE 12
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

COPCs	Surface Soils Area A	Surface Soils Area B/C	Surface Soils Wood/Debris Disposal Area	Shallow Subsurface Soil	Shallow Ground-water (total)	Shallow Ground-water (dissolved)	Deep Ground-water (total)	Deep Ground-water (dissolved)	Surface Water (total)	Surface Water (dissolved)	Sediment
Volatiles:											
1,1-Dichloroethane					X	X					
1,2-Dichloroethane									X	X	
1,1-Dichloroethene					X	X					
cis-1,2-Dichloroethene					X	X			X	X	
1,1,1-Trichloroethane					X	X					
Trichloroethene	X				X	X			X	X	X
Vinyl Chloride									X	X	
Semivolatiles:											
Benzo(a)anthracene	X	X	X	X							X
Benzo(a)pyrene	X	X	X	X							X
Benzo(b)fluoranthene	X	X	X	X							X
Benzo(k)fluoranthene	X	X	X	X							X
Chrysene	X	X	X	X							X
Dibenzo(a,h)anthracene	X		X	X							X
Indeno(1,2,3-cd)pyrene	X	X	X	X							X
Phenanthrene											X
Pyrene											X

TABLE 3-1 (Continued)

CHEMICALS OF POTENTIAL CONCERN (COPCs) PER MEDIA
SITE 12
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

COPCs	Surface Soils Area A	Surface Soils Area B/C	Surface Soil Wood/Debris Disposal Area	Shallow Subsurface Soil	Shallow Ground-Water (total)	Shallow Ground-Water (dissolved)	Deep Ground-Water (total)	Deep Ground-Water (dissolved)	Surface Water (total)	Surface Water (dissolved)	Sediment
Pesticides/PCBs:											
4,4'-DDE											X
Heptachlor Epoxide					X	X					
Aroclor-1242											X
Aroclor-1248	X										
Aroclor-1254	X										X
Aroclor-1260	X			X							X
Nitramines:											
Nitrobenzene					X	X					
RDX					X	X					
1,3,5-Trinitrobenzene	X										
2,4,6-Trinitrotoluene	X										
Inorganics:											
Aluminum	X	X	X	X	X		X				X
Antimony	X	X		X	X	X				X	X
Arsenic	X	X	X	X	X	X	X	X	X	X	X
Barium	X			X	X						
Beryllium	X	X	X	X	X						X
Cadmium	X			X					X	X	X
Chromium	X			X	X						X
Copper	X			X							

TABLE 3-1 (Continued)

CHEMICALS OF POTENTIAL CONCERN (COPCs) PER MEDIA
SITE 12
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

COPCs	Surface Soils Area A	Surface Soils Area B/C	Surface Soil Wood/Debris Disposal Area	Shallow Subsurface Soil	Shallow Ground-Water (total)	Shallow Ground-Water (dissolved)	Deep Ground-Water (total)	Deep Ground-Water (dissolved)	Surface Water (total)	Surface Water (dissolved)	Sediment
Inorganics (Continued):											
Cyanide (total)									X		
Lead	X			X	X						
Manganese	X			X	X		X	X	X	X	X
Mercury	X										X
Nickel	X				X						
Silver											X
Thalliuim	X				X						
Vanadium	X			X	X						X
Zinc	X			X							X

TABLE 3-2

ECOLOGICAL CONTAMINANTS OF CONCERN (ECOCs) PER MEDIA
SITE 12
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN,VIRGINIA

Contaminant	Surface Water	Sediment	Surface Soil Area A	Surface Soil Area B/C	Surface Soil Wood Debris/Disposal Area
Volatiles:					
2-Butanone		x			
Semivolatiles:					
Acenaphthene		x	x		x
Acenaphthylene			x		
Anthracene		x	x	x	x
Benzo(a)anthracene		x	x	x	x
Benzo(b)fluoranthene			x	x	x
Benzo(k)fluoranthene		x	x	x	x
Benzo(g,h,i)perylene		x	x	x	x
Benzo(a)pyrene		x			
Carbazole		x	x	x	x
Chrysene		x	x	x	x
Dibenz(a,h)anthracene		x			x
Dibenzofuran			x		x
1,4-Dichlorobenzene			x	x	
Fluoranthene		x	x	x	x
Fluorene		x	x		x
Indeno(1,2,3-cd))pyrene		x	x	x	x
Naphthalene		x			
Phenanthrene		x	x		x
Pyrene		x	x	x	x
Pesticides/PCBs:					
4,4'-DDD		x			
4,4'-DDE		x			
alpha-Chlordane		x			
gamma-Chlordane		x			
Endosulfan I		x			
Endrin Aldehyde		x			
Aroclor - 1242		x			
Aroclor - 1248			x		
Aroclor - 1254		x	x		
Aroclor - 1260		x	x		

TABLE 3-2(Continued)

ECOLOGICAL CONTAMINANTS OF CONCERN (ECOCs) PER MEDIA
SITE 12
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN,VIRGINIA

Contaminant	Surface Water	Sediment	Surface Soil Area A	Surface Soil Area B/C	Surface Soil Wood Debris/Disposal Area
Nitramines:					
2,4-Dinitrotoluene			x		
1,3,5-Trinitrobenzene			x		
Inorganics:					
Aluminum		x			
Antimony		x	x		
Arsenic		x			
Barium			x		
Beryllium		x			
Cadmium	x	x	x		
Chromium	x		x		
Cobalt		x			
Copper		x	x		
Cyanide, total	x	x	x		
Iron	x	x	x		
Lead		x	x	x	
Manganese	x	x	x		
Mercury		x	x	x	
Nickel		x	x		
Selenium		x	x	x	
Silver		x	x		
Thallium			x		
Vanadium			x		
Zinc		x	x	x	

3.2.7 Feasibility Study

As a result of the Round Two RI, an FS was initiated in 1995 to address chemicals of concern (COCs) in each media of concern and potential ecological concerns. COCs are derived from the list of COPCs and ECOCs identified in baseline RAs that produce 95 percent of the unacceptable human health or ecological risks. Remediation Levels (RLs) were developed for each COC in each medium. RAAs were then developed and evaluated for COCs in media of concern in the FS. These RAAs are summarized later in this ROD.

During the development of the FS, media of concern were re-prioritized from groundwater (focus of the Draft FS) to Area A soils. The basis for the re-prioritization included the quality of shallow groundwater (i.e., groundwater is not potable) in the vicinity of Site 12, levels of inorganics (primarily lead) in Area A and the potential for current human and ecological exposure to affected media. The highly erosional nature of Site 12 and the potential impact on Ballard Creek were also considered. As a result, groundwater RAAs featured in die Draft FS were placed in Appendix F and RAAs for Area A soil were developed. Area A soil RAAs are featured in both the Draft Final and Final FS Reports.

4.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The Final RI and FS reports, along with the Final PRAP for Site 12 at WPNSTA Yorktown were released to the public on July 1, 1996. These documents were made available to the public in the information repositories maintained at the following locations:

- York County Public Library
- Gloucester Public Library
- Newport News City Public Library
- WPNSTA Yorktown, Environmental Directorate, Building 31-B

A notice of availability of the RI/FS reports and the PRAP was published in The Daily Press on June 30,1996. A public comment period regarding Site 12 was held from July 1, 1996 to August 14, 1996; and a public meeting regarding the same was held on July 26, 1996 at the York County Recreational Services Meeting Room, 301 Goodwin Nock Road. The purpose of the public meeting was for the Department of the Navy (DoN), United States Environmental Protection Agency (USEPA), and Commonwealth of Virginia representatives to answer questions and accept public comments on the PRAP for Site 12. Response to the comments received during the comment period are included in the Responsiveness Summary of this ROD.

This decision document presents the selected remedial action for Site 12 chosen in accordance with CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA) and, to the extent practicable, the NCP. The decision for Site 12 is based on the administrative record.

5.0 SCOPE AND ROLE OF THE RESPONSE ACTION

The selected remedial action is the overall strategy for the Site 12 study area. The action will remediate the contaminated soil in Area A (OU III) and will monitor the quality of the groundwater, surface water, and sediment across the study area (OU V). No Action is specified for Area B/C and Wood/Debris Disposal Area soils (OU IV). No further actions are anticipated to be conducted at Site 12.

Based on the results of the baseline RAs, there are three potential media of concern present at Site 12: contaminated soil in Area A; TCE-contaminated groundwater in the Cornwallis Cave (shallow) aquifer, and inorganic- and polynuclear aromatic hydrocarbon (PAH)-contaminated sediment in Ballard Creek. Of these three media, the FS determined that only the contaminated soil in Area A (i.e., OU III) will require remediation. COCs for Area A soils are presented in Table 5-1. Figure 5-1 illustrates Area A and the extent of contaminated soil as defined by an exceedance of the USEPA lead action limit of 400 milligrams per kilogram (mg/Kg). Soil concentrations exceeding 400 mg/Kg of lead occur in ash and ash affected soils. The presence of ash in Area A is an indicator of past disposal practices associated with open burning practices and operation of the incinerators at Site 12. An evaluation of the extent of contamination due to other COCs at Area A indicates that remediation of site soils using the USEPA lead action limit of 400 mg/Kg will result in the remediation of all soil contaminants, organics as well as inorganics, to levels that protect human health and the environment.

Groundwater in the Cornwallis Cave aquifer will not be subjected to remediation at this time for the following reasons: 1) groundwater in the Cornwallis Cave aquifer and the Upper Yorktown-Eastover aquifer are not currently used for any purpose and are not potable because of low yields, high iron, pH and other characteristics at WPNSTA Yorktown and TCE did not exceed its risk-based remediation level derived assuming future beneficial use; and 2) flow rates and the potential existence of solution cavities common to the Cornwallis Cave aquifer at Site 12 present technical limitations to the effectiveness of any groundwater extraction or in situ treatment system. Because groundwater is not potable in the vicinity of the site, a future beneficial use scenario was used in the development of risk based RLs. Beneficial use of underlying groundwater was assumed to be the washing of cars or watering of lawns. Potential exposure associated with this future potential exposure scenario will be discussed in detail in Section 7.0 of this document.

TABLE 5-1

CHEMICALS OF CONCERN
SITE 12 - AREA A SURFACE SOILS
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Chemical of Concern	Maximum Value (mg/Kg)	Area of Highest Detection	Rationale	Background (mg/Kg)
1,3.5,-Trinitrobenzene	3.7	Area A	Human Health/ Ecological	ND
Antimony	28.5L	Area A	Human Health	9.2 to 11L
Cadmium	25.7	Area A	Human Health/ Ecological	1.3K to 1.5
Manganese	1,230	Area A	Human Health	7.6L to 491
Lead	3,240	Area A	Human Health	6.4 to 43.1

Notes:

ND = Not detected
L = Biased Low
K = Biased High
mg/kg = milligrams per kilogram

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Although COCs were detected in the surface water and sediment of Ballard Creek, Ballard Creek will not be subjected to remediation at this time for the following reasons: 1) there are no unacceptable current or future potential human health risks associated with exposure to surface water or sediments; 2) there are no unacceptable ecological risks; 3) there are no enforceable chemical-specific applicable or relevant and appropriate requirements (ARARs) for sediment; and 4) treatment of the sediments would require dredging which would be more harmful to the environment than the presence of contamination. However, OU V is not exempt from being considered for remediation in the future.

Human health risks and potential ecological effects associated with Area B/C and Wood/Debris Disposal Area soils fall within acceptable ranges. Therefore, no action is specified for OU IV.

Although RAAs were not proposed for groundwater in the Cornwallis Cave aquifer, surface water or sediment in Ballard Creek (i.e., OU V), a monitoring program will be implemented to ensure that the groundwater quality and surface water/sediment quality do not further deteriorate. The monitoring of groundwater will be conducted as per the NCP because contamination in the shallow aquifer will result in future property use restrictions in the WPNSTA Master Plan. The monitoring program for Ballard Creek surface water and sediment will be implemented as agreed to by USEPA Region III, the Commonwealth of Virginia and the Navy. The OU V monitoring program will include periodic sampling and analysis of groundwater in the Cornwallis Cave (shallow) and Yorktown-Eastover (deep) aquifers, and surface water and sediment in Ballard Creek. The details of the program (e.g., sampling location frequency, duration, and analyses) will be identified in a long-term monitoring work plan that will be prepared as a primary document under the Federal Facility Agreement (FFA). If the monitoring program indicates that groundwater, surface water, or sediment quality is deteriorating, remediation of these media may be considered. In addition, long-term monitoring (as per the NCP) will be included under the selected remedy for Area A (OU III) soil. Long-term monitoring is required to determine the overall protectiveness of the remedy. Goals for long-term monitoring will be presented in Section 10.0 of this document.

6.0 SUMMARY OF SITE CHARACTERISTICS

This section briefly describes the analytical results of the Round Two RI and the nature and extent of contamination (i.e., the site characteristics) in surface soil, subsurface soil, groundwater, surface water, and sediment at Site 12.

6.1 Surface Soil

Surface soil at Site 12 has been impacted by site operations. Area A has been most affected as indicated by the presence of inorganics (including lead), PAHs, and relatively low levels of PCBs. Low levels of TCE, pesticides, and nitramine compounds also were detected. Also affected, but to a lesser degree, are Area B/C and the Wood/Debris Disposal Area. Although no VOCs, PCBs, or nitramine compounds were detected in Area B/C, PAHs and inorganic analytes were detected. To an even lesser extent, the Wood/Debris Area has been affected by PAHs and inorganic contamination. Tables 6-1 through 6-3 present a summary of select surface soil COPCs for each area.

The source of surface soil contamination is apparently the past disposal of wastes at Site 12. Area A has been most affected by the receipt of ashes from the incinerator, open burning, and from the landfilling of other materials (construction debris, steel containers, and piping) as evidenced by surface debris.

PCBs detected in Area A could be associated with the historical use of antifoulans on underwater mines and mine cable. Pesticides are likely present at Site 12 because of past legal application of these constituents. The presence of PAHs and inorganic contaminants can most likely be attributed to the disposal of ashes from the incinerator and open burning.

6.2 Subsurface Soil

Subsurface soil at Site 12 has been impacted by past site operations at Area A. With respect to organic contamination, PAHs and one PCB (Aroclor-1260) were detected in two shallow subsurface (2 to 4 feet below ground surface [bgs]) soil samples.

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<IMG SRC97181K>

TABLE 6-2

SITE 12 - AREA B/C
SURFACE SOIL COPC SUMMARY
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Contaminant (1)	Contaminant Frequency/Range (1)(2) No. of Positive Detects/ No. of Samples	Range of Positive Detection (mg/Kg)	Station-wide Background(3) No. of Positive Detects/ No. of Samples	Range of Positive Detections (mg/Kg)	RGO Adolescent/Adult Trespassers (mg/Kg)
Semivolatiles:					
Benzo(a)anthracene	5/11	0.1J-0.45	2/13	0.12J-0.24J	34
Benzo(a)pyrene	5/11	0.11J-0.52	2/13	0.14J-0.18J	3.4
Benzo(b)fluoranthene	7/11	0.057J-1.7	3/13	0.23J-0.5	34
Benzo(k)fluoranthene	5/11	0.068J-0.52	2/13	0.12J-0.13J	340
Chrysene	6/11	0.041J-0.94	3/13	0.14J-0.27J	3.4
Indeno (1,2,3-cd) pyrene	5/11	0.052J-0.31J	1/3	0.16J	34
Inorganics:					
Aluminum	11/11	2,780-12,000	44/44	1,960-19,200	420,000.0
Antimony	1/11	3.5L	2/42	9.2L-11L	170
Arsenic(as carcinogen)	11/11	1.3-8.5	44/44	0.46L-63.9	60.0
Beryllium	11/11	0.08-038	31/44	0.23J-0.93J	15.0

Notes:

COPC = Contaminant of potential concern
ND = Not detected
RGO = Remediation Goal Option

(1) Organic concentrations converted from micrograms per kilogram (mg/Kg) to milligrams per kilogram (mg/Kg), Inorganic concentrations reported in mg/Kg.
(2) J = Analyte was positively identified, value is estimated.
K = Analyte was positively identified, value is biased high.
L = Analyte was positively identified, value is biased low.
(3) Anthropogenic samples used for comparison to organic COPCs.

TABLE 6-3

SITE 12 - WOOD/DEBRIS DISPOSAL AREA
SURFACE SOIL COPC SUMMARY
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Contaminant (1)	Contaminant Frequency/Range (1)(2) No. of Positive Detects/ No. of Samples	Range of Positive Detection (mg/Kg)	Station-wide Background(3) No. of Positive Detects/ No. of Samples	Range of Positive Detections (mg/Kg)	RGO Adolescent/Adult Trespassers (mg/Kg)
Semivolatiles:					
Benzo(a)anthracene	4/8	0.042J-2	2/13	0.12J-0.24J	34.0
Benzo(a)pyrene	2/8	0.17J-1.6	2/13	0.14J-0.18J	3.4
Benzo(b)fluoranthine	5/8	0.047J-2.6	3/13	0.23J-0.5	34.0
Benzo(k)fluoranthene	3/8	0.039J-0.82	2/13	0.12J-0.13J	340.0
Chrysene	4/8	0.058J-2.1	3/13	0.15J-0.27J	3,400.0
Dibenzo(a,h)anthracene	1/8	0.21J	0/13	ND	3.4
Indeno (1,2,3-cd) pyrene	2/8	0.11J-0.58	1/13	0.16J	34.0
Inorganics:					
Aluminum	8/8	3,530-9,470	44/44	1,960-19,200	420,000.0
Arsenic (as carcinogen)	8/9	2.5-10.6	44/44	0.46L-63.9	60.0
Beryllium	6/8	0.22-0.7	31/44	0.23J-0.93J	15.0

Notes:

COPC = Contaminant of potential concern
ND = Not detected
RGO = Remediation Goal Option

(1) Organic concentrations converted from micrograms per kilogram (ɪg/Kg) o milligrams per kilogram (mg(Kg), Inorganic concentrations reported in mg/Kg.
(2) J = Analyte was positively identified, value is estimated.
K = Analyte was positively identified, value is biased high.
L = Analyte was positively identified, value is biased low.
(3) Anthropogenic samples used for comparison to organic COPCs.

inorganic analytes (including lead) were detected in subsurface soil samples at concentrations exceeding the Station-wide background levels. The presence of these constituents in Area A subsurface soil is associated with the presence of ash from the incinerator and open burning, not the leaching of contaminants to deeper soil (see Table 6-4). Because these soils fall in shallow subsurface soil horizon, Remediation Goal Objectives (RGOs) for surface soils are presented for comparative purposes.

Subsurface soil samples obtained throughout Site 12 proper indicate that areas other than Area A are not significantly impacted by past site operations. Inorganics detected in the subsurface soil samples outside of Area A appear to be similar to Station-wide background conditions. However, because of the debris present in these areas, subsurface soil samples were not obtained directly in the disposal areas (See Table 6-5).

6.3 Groundwater

Groundwater in the Cornwallis Cave aquifer (i.e., the shallow aquifer) at Site 12 has been impacted by past Station operations. TCE was detected in five of seven on-site monitoring wells. In addition, TCE was detected in 8 of 11 monitoring wells situated upgradient and side-gradient of Site 12. The highest concentration of TCE (3,300 micrograms per liter [Ig/L]) was detected in a groundwater seep (15SW12) downgradient of the highest concentration of TCE detected in groundwater (12GW15 at 1,300 Ig/L). These samples are located on the west side of Barracks Road between Industrial Area Buildings 3 and 4. Based on the history of Buildings 3, 4, 5, and 6, it is likely that TCE in the shallow groundwater is associated with former USTs that received waste oil and solvents and historical use of TCE as a degreaser in the Industrial Area. Groundwater in the shallow Cornwallis Cave aquifer and the deeper upper Yorktown-Eastover aquifer is not currently used for drinking purposes at WPNSTA Yorktown. Groundwater from the Cornwallis Cave aquifer contains relatively high concentrations of iron, manganese and low water yields are characteristic of the formation. Groundwater in the upper Yorktown-Eastover exhibits relatively high pH values throughout WPNSTA Yorktown and, therefore, could not be used as a potable source without pre-treatment. Groundwater in both the Cornwallis Cave aquifer and the Yorktown-Eastover aquifer exceeds the Commonwealth of Virginia hardness criteria in most wells. As such these water bearing units could be considered Class III aquifers. Table 6-6 presents chemical data supportive of Class III aquifer status. These data have been compiled from background monitoring wells located throughout the Station and have not been affected by Site 12 activities. Because groundwater in the Cornwallis Cave aquifer and upper Yorktown-Eastover aquifer cannot be used for future potable purposes without pretreatment, a future beneficial use scenario was developed to evaluate potential exposure. Human exposure under the future beneficial use scenario will be discussed in Section 7.0. TCE concentrations detected in shallow groundwater do not exceed the remediation level (16,000 Ig/L) derived for the future beneficial use of Site 12 groundwater.

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TABLE 6-5

SITE 12.- PROPER
SUBSURFACE SOIL COPC SUMMARY
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

	Contaminant Frequency/Range (1)(2)		Station-wide Background (3)	
Contaminant (1)	No. of Positive Detects/ No. of Samples	Range of Positive Detections (mg/kg)	No. of Positive Detects/ No. of Samples	Range of Positive Detections (mg/Kg)
Inorganics:				
Aluminum	8/8	4,230-28,800	16/16	2,710-28,200
Antimony	2/8	7.1L-230L	2/13	8.5L-31.3L
Arsenic (as carcinogen)	8/8	0.58-20.3	16/16	0.23J-42.7
Beryllium	3/8	0.23-0.45K	13/16	0.3J-9.8
Chromium	8/8	3.6-90.6	16/16	5.2L-33.5
Manganese	8/8	17.4-1,040	16/16	3.5J-2,940
Vanadium	8/8	6.6-256	16/16	3.6J-330

Notes:

(1) Organic concentrations converted from micrograms per kilogram (Ig/Kg) to milligrams per kilogram (mg/Kg), Inorganic concentrations reported in mg/Kg.
(2) J = Analyte was positively identified, value is estimated.
K = Analyte was positively identified, value is biased high.
L = Analyte was positively identified, value is biased low.
(3) Anthropogenic samples used for comparison to organic COPCs.

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Inorganic analytes detected in groundwater are similar to Station-wide background conditions. Groundwater samples obtained from the Yorktown-Eastover aquifer did not exhibit VOC contamination, indicating that vertical migration of contamination through the Yorktown confining unit has not occurred. The horizontal and vertical extent of TCE in Site 12 groundwater is presented in Appendix A, Figures A.1 through A.8 of this ROD.

6.4 Surface Water

Surface water at Site 12 has been slightly impacted by site operations. Relatively low concentrations of VOCs (TCE, cis-1,2-dichloroethene, and 1,1-dichloroethene) were detected in samples collected from the stream channels and from Ballard Creek. Of the VOCs, TCE was detected most frequently with concentrations ranging from 0.5J to 6.5 Ig/L. Vinyl chloride (7 Ig/L) was detected in one surface water sample obtained from the stream channel near the toe of the Wood/Debris Disposal Area. TCE was also detected in an upstream sample along Ballard Creek (12SWO9 at O.5J Ig/L). The source of TCE at this location is most likely the groundwater seep downgradient of the Industrial Area which will be addressed in OU V of this ROD by long-term monitoring of groundwater. In addition, TCE was detected upstream of SSA 15 at sample location 15SW10 at 340Ig/L. TCE does not, however, exceed its freshwater ambient water quality criteria for both acute and chronic effects (45,000 Ig/L and 21,900 Ig/L, respectively), nor does TCE exceed the Commonwealth of Virginia Water Quality Standard of 807 Ig/L. Furthermore, surface water concentrations of chlorinated volatiles and other contaminants do not pose unacceptable current or future human health risks. PAHs, PCBs, and nitramine compounds were not detected in the surface water samples. Figure 6-1 presents concentrations of TCE detected in Ballard Creek surface water.

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6.5 Sediment

Sediment at Site 12 has been impacted by past site operations. The primary contaminants detected in sediment samples included PAHs, pesticides, PCBs, and inorganics. Figure 6-2 presents COC concentrations that exceed corresponding Effect Range-Median (ER-M) values. In general, environmental effects are considered probable when sediment concentrations exceed ER-Ms. Table 6-7 presents maximum detected values for sediment contaminants exceeding Effects Range-Low (ER-L; concentration in sediment above which ecological effects are possible) and ER-M values. Exceedances of ER-L and ER-M values occur mainly in the sediment samples obtained from Site 12 drainage ditches. Highest sediment concentrations of site related COCs occur mainly at sediment location SD12, where PAHs, PCBs, lead and mercury were detected. This sediment location is located directly downstream of Area A and, as such, is indicative of contamination in Area A soils. Area A soil will be addressed by the remedy selected in this ROD. ER-M exceedences; in sediments of Ballard Creek proper are generally associated with non-site related contaminants such as pesticides (alpha-chlordane and 4,4'-DDD) or occur in deeper sediments obtained from the 4 to 8 inch depth interval (cadmium at location SD17-02). Therefore, risk to aquatic ecological receptors in Ballard Creek posed by Site 12 is limited.

Furthermore, potential human health cancer risks associated with current and future sediment exposure fall within USEPA's acceptable risk range. Similarly, adverse noncarcinogenic human health risks are not expected to occur subsequent to exposure. This is indicated by the Hazard Index (HI) values below 1.0 for sediment exposure. Therefore, RAAs were not developed for this medium.

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7.0 SUMMARY OF SITE RISKS

As part of the Round Two RI, a baseline RA was conducted which included both a human health RA and an ecological RA to evaluate potential risks to human receptors and the environment resulting from the presence of COPCs at Site 12. The following subsections describe the results of these RAs.

7.1 Human Health Risk Assessment

As part of the human health RA, COPCs were identified in the surface soil, subsurface soil, shallow groundwater, deep groundwater, surface water, and sediment. These COPCs included VOCs, PAHs, pesticides, PCBs, nitramine compounds, and inorganics including lead and cadmium. For each potential receptor, total risks were estimated by disposal area (Area A, Area B/C and the Wood/Debris Disposal Area) for current trespasser and future potential residential receptors as discussed below. Potential carcinogenic and noncarcinogenic risks were estimated for the COPCs. Carcinogenic risk is expressed, for those carcinogenic COPCs having cancer slope factors (CSFs), as an incremental cancer risk (ICR) value which is the estimated incremental probability of an individual developing cancer over a lifetime because of exposure to a potential carcinogen. Current Federal guidelines for acceptable carcinogenic risks are in the range of 1 x 10 -06 to 1 x 10 -04 (one in one million to one in ten thousand). Systemic or noncarcinogenic health effects are evaluated through the derivation of a HI, which is the ratio of contaminant uptake to a reference dose (RfD) value. Exposure resulting in a chemical uptake equal to or exceeding the RfD value ran result in the expression of adverse noncarcinogenic health effects. The HI value is, therefore, an indicator of potential noncarcinogenic adverse health effects such that an HI value greater than or equal to 1.0 indicates the potential for adverse systemic health effects. An HI below 1.0 indicates that systemic effects will not occur subsequent to exposure.

7.1.1 Current Potential Receptors

Potential current receptors to COPCs detected in environmental media at Site 12 include adolescent and adult trespassers. The total ICR values for these current scenario receptors fell within the generally acceptable target risk range of 1 x 10 -04 to 1 x 10 -06 as determined by the USEPA. HIs for current potential human receptors in Area B/C and the Wood/Debris Disposal Area fell below 1.0. However, the total HI value estimated for the potential receptors in Area A exceeded 1.0. These His were 1.2 for the adult trespasser, and 1.5 for the adolescent trespasser. Contaminants responsible for these elevated HIs are.1,3,5-TNB, antimony, cadmium, and manganese in Area A soil.

Cancer risks to current potential receptors exposed to surface water and sediment fall within USEPA's target range of 1 x 10 -04 to 1 x 10 -06 and HI values below 1.0, indicating that systemic adverse health effects will likely not occur. There is no current potential exposure to groundwater underlying Site 12. Table 7-1 presents a summary of risk values and HIs by area for current potential human receptors.

7.1.2 Future Potential Receptors

The potential human receptors evaluated under the future scenarios include future adult and young child residents and future adult construction workers. Property use at Site 12 will remain the same in the foreseeable future and future residential development of Site 12 by the Navy is highly unlikely (although not prohibited). Because of poor groundwater quality in both the Cornwallis Cave aquifer and the deeper and Upper Yorktown-Eastover aquifer, groundwater would not be used for drinking purposes. Untreated groundwater could however be used for beneficial purposes such as watering lawns or washing cars. For the sake of conservatism, future-beneficial use of Site 12 groundwater was evaluated in the FS report to establish groundwater RL values.

7.1.2.1 Future Residents

Because of the relatively high concentrations of lead detected in Area A surface soil, the USEPA Lead Uptake Biokinetic (UBK) Model was used to determine if accidental ingestion exposures to lead by future resident children in Area A surface soil would result in unacceptable blood lead levels. The model indicated a 45 percent probability that blood lead levels in young children would exceed the action level of 10 micrograms per deciliter (Ig/dl) following accidental surface soil ingestion in Area A. According to USEPA guidance, exceedence of this blood lead level may result in unacceptable risks to this receptor group.

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Total ICR values estimated for future potential adult and child receptors at Site 12 exceed USEPA's target risk range of 1 x 10 -04 to 1 x 10 -06. Exceedence of the risk range is associated with the reasonable maximum exposure by future residents to TCE in the shallow groundwater, if it is used in the future for drinking purposes. Central tendency (i.e., average) estimates of potential exposure and subsequent cancer risks associated with potable groundwater usage fall within the upper end of the target risk range, Groundwater also contributes to the total HI value, which exceeds 1.0 indicating the potential for adverse noncarcinogenic health effects to occur subsequent to exposure. An evaluation of potential exposure by pathway for both adult and child receptors indicates that exposure to Area A soils and potable use of groundwater account for all of the unacceptable risks and HI values associated with Site 12. Tables 7-2 through 7-4 present the risk values and His associated with future residential property use and the future potable use of groundwater at Site 12.

Because of groundwater quality in both the shallow Cornwallis Cave aquifer and the Upper Yorktown-Eastover aquifer, potable use of these water-bearing units is highly unlikely without pretreatment Therefore, the future beneficial use of groundwater was evaluated in the FS report. The future beneficial use scenario was assumed to be lawn watering and washing of cars. This scenario combines dermal and ingestion exposure pathways and assumes that adults and adolescents (7 to 15 years of age) would likely be involved in beneficial use activities. An RL of 16,000 Ig/L was derived for TCE to prevent the occurrence of future noncarcinogenic adverse health effects. TCE concentrations do not approach or exceed 16,000 Ig/L at any monitoring well location associated with Site 12.

ICR values and HI values derived for Area B/C soil and Wood/Debris Disposal Am soil, surface water and sediments fall within the USEPA target risk range and are less than 1.0, respectively. The UBK model was not used for either Are& B/C soil or the Wood/Debris Disposal Area soil because lead concentrations detected in these areas were similar to Station-wide background.

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<IMG 97181QB>
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7.1.2.2 Future Adult Construction Worker

Future potential adult construction workers could be exposed to COPCs in subsurface soil during future building/excavation activities at Site 12. The total ICR estimated for this receptor was within USEPA's acceptable target risk range of 1 x 10-04 to 1 x 10-06; however, the total HI (1.5) exceeded 1.0 because of the presence of antimony and other inorganics in Area A only. Antimony and inorganic concentrations detected in subsurface soil sampling locations outside of Area A were similar to concentrations observed in Station-wide background subsurface soil. These constituents therefore, are not attributable to past Site 12 activities.

7.2 Ecological Risk Assesment

During the ecological RA, ECOCs were identified in the surface soil, surface water, and sediment at Site 12. These ECOCs included VOCs, semivolatile organic compounds (SVOCs), pesticides, PCBs, nitamines, and inorganics. The results from the ecological RA indicated that overall SVOCs, pesticides, PCBs, nitamine compounds, and inorganics detected in Area A soil appear to have the most potential to affect ecological receptors at Site 12. Specific conclusions with respect to the aquatic and terrestrial ecosystems are presented below.

7.2.1 Aquatic Ecosystem

Surface water concentrations of cadmium, chromium and cyanide exceeded surface water screening levels (SWSLs) and were elevated above background concentrations (see Table 7-5). Cadmium exceeded its chronic SWSL in two surface water samples. One surface water sample was obtained from the ditch adjacent to the Wood/Debris Disposal Area (12SW16) and the other sample was obtained from location 12SW17 in Ballard Creek proper. Cadmium was not detected in surface water samples obtained from the ditch bisecting Area A or downstream surface water locations in Ballard Creek proper between the Area A and 12SW17. It is also important to note that cadmium was detected in dissolved (filtered) surface water samples and not total (unfiltered) surface water samples. As such, the presence of cadmium in surface water samples may be an analytical anomaly and not associated with Site 12. Furthermore, detected concentrations of cadmium do not exceed its acute SWSL only the more conservative chronic SWSL value.

TABLE 7-5

FREQUENCY AND RANGE OF DETECTION OF SELECTED SURFACE WATER ECOCs
COMPARED TO USEPA REGION III FRESHWATER SCREENING LEVELS
SITE 12
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

	Surface Water Screening Levels (SWSLs)		Contaminant Frequency/Range					
Analyte	Acute	Chronic	No. of Positive Detects/No. of Samples	Range of Positive Detections	No. Of Positive Detects Above Lowest SWSL	Background	Ecological Contaminant of Concern?	Reason for Exclusion
Organics (ɪg/L):								
1,2-Dichloroethane	218,000	20,000(1)	/10	0.6J	0	ND	NO	Below SWSL
cis-1,2-Dichloroethene	11,600	NE	2/10	1.2-10	0	ND	NO	Below SWSL
Trichloroethene	45,000(2)	21,900	6/10	0.5.J - 6.5	0	ND	NO	Below SWSL/ Lab Contaminant
Vinyl Chloride	11,600	NE	1/10	7.7J	NA	ND	NO	Below SWSL
Inorganics (ɪg/L):								
Cadmium	13.6(2)(3)	0.15	2/10	5.2K - 8.4K	2	ND	YES	
Chromium	16(l)	1(4)	6/10	3.4K - 10K	6	9.8J	YES	
Cyanide	22(l)	5.2	1/6	230	1	ND	YES	
Lead	332.6(1)(3)	1	5/10	1.1-2	5	1.6J - 15.9	NO	Background

Notes:

(1) USEPA, 1987.
(2) USEPA, 1992b
(3) Value based on an average hardness of 301.4 mg/kg CaCO3
(4) Chromium VI level

ECOC = Ecological contaminants of concern
NE = Not Established
NA = Not Applicable
J = Estimated value
K = Value biased high
L = Value biased low
ɪg/L = microgram per liter
SWSL = surface water screening level

Chromium was detected in total (unfiltered) surface water samples obtained from both the ditches and Ballard Creek proper in excess of its chronic SWSL. Chromium was not detected in dissolved (filtered) surface water samples. The presence of chromium in surface water could, therefore, be associated with suspended sediments in the water column present because of sampling techniques and the potential to disturb sediments during the sampling process. Cyanide was detected in only one surface water sample (12SW15) obtained from an upstream location in the ditch adjacent to the Wood/Debris Disposal Area.

Cyanide was not detected in the dissolved (filtered) sample obtained at location 12SW15 nor was it detected in dissolved or total surface water samples at any other location. Because of the sporadic nature of their occurrence and the relatively low concentrations observed in surface water (i.e., above the chronic SWSL but below the acute SWSL), COCs detected in surface water will not adversely affect aquatic receptors in Ballard Creek.

The benthic community at Site 12 was evaluated to determine whether sediment COCs have had a deleterious effect on the quality of Ballard Creek. To determine the potential effect of sediment COCs on sediment/ water quality, the Macroinvertebrate Biotic Index (MBI) was derived for each sampling station. The sediment at Site 12 contained elevated levels of SVOCs, pesticides, PCBs, and inorganic constituents. The presence of pesticides in Site 12 sediments is likely because of past legal application of these constituents at WPNSTA Yorktown, not specific site activities. As such, pesticides are not considered to be site related. The MBI is a numeral indication of the type and number of benthic macroinvertebrate taxa at any sampled location. The MBI therefore provides an indication of general stream/water quality. The MBI is evaluated in the following manner:

MBI	<5.24	525-5-95	5.96-6.67	6.69-7.70	>7.71
Water Quality Classification	Excellent Water Quality	Good Water Quality	Good/Fair Water Quality	Fair Water Quality	Poor Water Quality

Benthic, macroinvertebrate results are presented on Figure 7-1.

Benthic results indicate that COCs from Site 12 pose limited risk to aquatic receptors in Ballard Creek, and that the benthic environment may also be adversely impacted by other ecological stressors. Other potential stressors to the benthic community that may create an unfavorable habitat include disturbances from Station operations or excessive stormwater runoff and erosion into the shallow streams. Sediment samples were subjected to grain size analysis to determine the physical characteristics of the sediment microenvironment (Figure 7-2). In general, upstream sediment locations where the MBI is lower, (indicating better water quality) are comprised of fine sands whereas downstream locations are comprised of a mixture of fine, medium and coarse sand, silts/clays and some gravel. Sediment samples obtained from intermittent streams that converge with Ballard Creek have a relatively higher percentage of medium sands, coarse sands and silt/clay. Erosion events along the Ballard Creek watershed explain the general changes observed in sediment grain size results and contribute to higher (indicating poor water quality) observed MBI values in downstrearn locations. Furthermore, benthic sampling stations at Site 12 had species abundance and densities similar to background stations on similar water bodies.

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7.2.2 Terrestrial Ecosystem

Area A is the most adversely impacted terrestrial environment at Site 12. Risk to the terrestrial environment in Area A is a result of surface soil concentrations of PAHs, PCBs, nitramine compounds, and inorganics. Area B/C soils exhibited concentrations of PAHs and several inorganic constituents which do not produce significant potential ecological risks. The Wood/Debris Disposal Area is similar to Area B/C in that soils exhibit PAHs and inorganic constituents. These constituents do not pose significant potential ecological risks. The following provides the terrestrial ecosystem conclusions for Area A, Area B/C, and the Wood/Debris Disposal Area. Quotient indices (Qis) derived for these areas using terrestrial uptake models are presented on Table 7-6.

QIs are derived by calculating a potential uptake or total daily intake (TDI) for each potential ecological receptor. The TDI considers uptake from the incidental ingestion of dust, dietary uptake and uptake from drinking water. The TDI is then compared to a toxicity reference value (TRV) in the following manner.

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Where:

n = the total number of individual ECOCs

<IMG SRC 97181QL>
<IMG SRC 97181QM>

QIs are conservative indicators of potential effects on terrestrial receptors. A QI equal to or exceeding 1.0 indicates a potential effect. A QI of less than 1.0 indicates that effects are unlikely to occur. The following subsection provides discussions concerning potential ecological effects for each Site 12 area using flora and fauna toxicity.

7.2.2.1 Area A

Exceedences of soil flora and fauna toxicity values indicate that concentrations of PAHs, PCBs, nitramine compounds, and inorganics, may be affecting the terrestrial environment. In addition, concentrations of 1,3,5-TNB, barium, cadmium, iron and selenium detected in Area A produce relatively high QI values indicating a potential risk to terrestrial receptors in this area. The occurrence of these contaminants in Area A soils are also responsible for QIs exceeding 1.0 for several terrestrial species of concern including the White-tailed Deer, Bobwhite Quail and Eastern Cottontail Rabbit.

7.2.2.2 Area B/C

PAHs and inorganics detected in Area B/C exceeded conservative flora and fauna toxicity values.

However QI values indicate little risk from soils to terrestrial ecological receptors because risks demonstrated in Area B/C terrestrial models were driven by the presence of cadmium in the surface v. er component of the soil model. When surface water is removed from terrestrial uptake models, QIs for all species of concern fall below 1.0 indicating that ecological effects will not occur. The exception is the shrew which, because of conservatism used in the estimation of dietary intake, exceeds 1.0 for Area B/C and Station-wide background as well. As a result, limited potential ecological risk is posed to terrestrial receptors in Area B/C. The model assumes that 90 percent of the shrews diet is comprised of invertebrates and the remaining 10 percent is vegetation. The current data base for invertebrates concerning contaminant uptake is limited. Therefore, invertebrates were represented by earthworms which were assumed to bioaccumulate 100% of all Site 12 soil contaminants. Using this approach to estimate dietary intake for the shrew is overly conservative because background concentrations for inorganics including cadmium result in QI values exceeding 1.0. If the model for the shrew was accurate, shrews would likely not exist at WPNSTA Yorktown because of background soil conditions. This is not the case because short-tailed shrews were identified during the natural heritage resource inventory conducted by the Virginia Department of Conservation and Recreation Division of Natural Heritage at WPNSTA Yorktown between April and November 1990. As such, the QI above 1.0 for the short-tailed shrew does not indicate a genuine ecological risk at Area B/C.

7.2.2.3 Wood/Debris Disposal Area

PAHs detected at the Wood/Debris Disposal Area exceeded flora and fauna toxicity values. However, QI values indicated limited potential ecological risk to terrestrial receptors.

Again, elevated QIs are based on the occurrence of cadmium in surface water. When the water component is removed from the uptake modeling effort, QI values are below 1.0 with the exception of the Eastern Cottontail Rabbit and the Shrew. The rabbit QI value exceeds 1.0 because of additivity of multiple chemicals to which the terrstrial receptor could be exposed. Individual contaminant QIs do not exceed 1.0 for the Eastern Cottontail Rabbit. Again, the shrew QI exceeds 1.0 because of conservatism in the estimation of dietary intake of contaminants from soil invertebrates. The shrew QI value also exceeds 1.0 for Station-wide soil background concentrations. Therefore, soil COCs pose limited risk to terrestrial ecological receptors in the Wood/Debris Disposal Area.

7.3 Conclusions of the Baseline RA

Results of the baseline RA indicated that human receptors exposed to constituents in Area A soils may exhibit potential adverse systemic health effects(i.e., HI>1.0). Constituents responsible for His above 1.0 include: 1,3,5-TNB; antimony; cadmium and manganese. Because an RfD value or a CSF is not available for lead, the UBK model was used to evaluate the potential blood lead level for a future child exposed to Area A soil. The UBK indicated a 45 percent probability that an exposed child would exhibit unacceptable blood lead levels. Area A soils contain ECOCs that exceed flora and fauna toxicity values and resulted in elevated QIs for terrestrial ecological receptors including the White-tailed Deer and the Bobwhite Quail. The weight-of-evidence approach indicates that Area A soil could adversely affect the terrestrial ecology of Site 12.

Cornwallis Cave aquifer groundwater has been impacted by chlorinated solvents from former USTs in the Industrial Area located upgradient of Site 12. Groundwater in the underlying Yorktown-Eastover aquifer does not exhibit the presence of chlorinated volatiles indicating that the Yorktown confining unit effectively separates these two water-bearing units in the vicinity of Site 12. The Cornwallis Cave aquifer and the Yorktown-Eastover aquifer are not currently used for potable purposes. General water quality of these units precludes their future potable use, however, no Commonwealth of Virginia or York County laws or restrictions currently prohibit the installation of groundwater wells in either aquifer. If groundwater is used for potable purposes in the future, unacceptable human risks (i.e.,ICR> 1 x 10 - 04) will result from the presence of TCE in the medium. Although future potable use of groundwater is unlikely, groundwater as a resource could be used for beneficial purposes such as watering lawns or washing of cars. A RL of 16,000 Ig/L for TCE was calculated for an adolescent or adult engaging in future beneficial use. TCE concentrations in groundwater are below the beneficial use RL value. Groundwater from the Cornwallis Cave aquifer likely discharges to Ballard Creek surface water along the southeaster portion of Site 12. Concentrations of volatiles in surface water samples are relatively low and pose no unacceptable risk to human health and the environment.

Human health risk and ecological effects associated with Area B/C and the Wood/Debris Disposal Area fall within the generally acceptable risk range and do not, by weight-of-evidence, indicate the potential for adverse terrestrial impacts. Surface water and sediment in Ballard Creek do not produce unacceptable human health risks and pose minimal risk to the aquatic environment.

8.0 DESCRIPTION OF ALTERNATIVES

Based on the results of the RA, the FS report identified Area A soil (OU III) as an AOC for which remedial alternatives should be developed. Remedial alternatives were also developed for the groundwater in the event that long-term monitoring of groundwater indicated further degradation of groundwater resource (i.e., groundwater poses an unacceptable risk). These groundwater alternatives are presented in Appendix B of this ROD. Because groundwater COCs do not exceed their corresponding beneficial use RL values, institutional controls with long-term monitoring was the selected alternative for groundwater. Specifics of the long-term monitoring program for groundwater will be developed as part of a long-term monitoring work plan which will be considered a primary document under the FFA. Ballard Creek will also be considered as part for the long-term monitoring for groundwater because shallow groundwater ultimately discharges to this surface water feature (OU V). Because Ballard Creek surface water and sediment pose no unacceptable human health risks or adverse ecological effects, remedial alternatives were not developed for these media. Because, human health and ecological risks associated with Area B/C soil, Wood/Debris Disposal Area soil (OU IV) were within generally acceptable ranges, remedial alternatives were not developed for this OU.

Various remedial technologies and process options were identified, screened, and evaluated during the FS for OU III. Ultimately, the following six RAAs were developed for the remediation of contaminated soil in Area A:

- Soil RAA 1: No Action
- Soil RAA 2: Institutional Controls, Monitoring, and Erosion Control
- Soil RAA 3: Soil/Clay (or clay equivalent) Cover
- Soil RAA 4: Excavation and Landfill Disposal
- Soil RAA 5: In Situ Solidification/Stabilization
- Soil RAA 6: Excavation and Soil Washing

A summary of each RAA is presented below. The cost and time to implement are estimated values.

8.1 Soil RAA 1: No Action

- Capital Cost: $0

- Annual Operation & Maintenance (O&M) Cost: $0
- Soil RAA net present worth (NPW): $0
- Time to Implement: 0

Under the no action RAA, no additional remedial actions will be performed for the contaminated Area A soil at Site 12. The no action alternative is required by the NCP to provide a baseline for comparison with other RAAs that provide a greater level of response.

8.2 Soil RAA 2: Institutional Controls, Monitoring, and Erosion Control

- Capital Cost: $450,000
- Annual O&M Cost: $15,000
- Soil RAA NPW: $680,000
- Time to Implement: Less than six months

Under Soil RAA 2, institutional controls, a long-term surface water montitoring program, and erosion controls measures will be implemented.

Institutional controls will include land use restrictions in the WPNSTA Master Plan of Base instruction that will limit future construction, residential development, and placement of new wells at Site 12.

The long-term monitoring program will include periodic surface water sampling in the Area A stream channel that discharges to Ballard Creek. At least four samples will be spaced along the stream channel and the samples will be analyzed for inorganics to ensure that soil contaminants do not migrate from Area A, and to monitor erosion along the stream channel.

The erosion control measures will include rip rap and vegetative matting. The rip rap will line the entire length of the Area A stream channel, from its beginning to the ponded area located approximately 75 feet northwest of the Station fence line. Erosion control will also remediate affected sediments in the Area A ditch stream channel be limiting direct contact by ecological receptors. The vegetative matting will be placed over steep slopes located along the stream channel within Area A.

8.3 Soil RAA 3: Soil/Clay (or clay equivalent) Cover

- Capital Cost: $740,000
- Annual O&M Cost: $21,000
- Soil RAA NPW: $1,100,000
- Time to Implement: Less than one year

Under Soil RAA 3, a soil/clay (or clay equivalent) cover will be placed over the contaminated soil exceeding the lead action limit of 400 mg/Kg to limit the potential for erosion, infiltration and direct contact by human and terrestrial ecological receptors. The lead action limit is used as an indicator of the extent of contamination in Area A which received ash and debris from the incinerator and open burning. Other COCs are associated with the ash/debris and remediating lead in Area A soil also remediates other COCs such as 1,3,5-TNB, antimony, cadmium and manganese. The cover will consist of 12 inches of compacted clay (or clay equivalent), 6 inches of topsoil, and cover an area of approximately 7,400 square yards. In areas where loose, uncompacted ash material is situated on steep slopes, cover construction may not be feasible. Depending on the specifics of the remedial design loose material may be excavated, debris removed, and spread on top of the flat portion of Area A which is already affected (Figure 8-1). The cover will then be constructed on the resulting soil pile. Periodically, the cover will be visually inspected and patched when needed. This alternative also includes the same institutional controls, monitoring plan, and erosion control measures included under Soil RAA 2.

8.4 Soil RAA 4: Excavation and Off-Site Landfill Disposal

- Capital Cost: $4,600,000
- Annual O&M Cost: $14,000
- Soil RAA NPW: $4,800,000
- Time to Implement: Less than one year

Under Soil RAA 4, the contaminated soil exceeding the lead action limit of 400 mg/Kg will be excavated, tested for Resource Conservation and Recovery Act (RCRA) characteristics to determine if it is hazardous or non-hazardous, then transported for disposal at a permitted landfill facility. Approximately 11,000 cubic yards of contaminated soil will require excavation and disposal. The excavation area will be backfilled with clean soil and revegetated. This alternative also includes the same institutional controls, monitoring plan, and erosion control measures included under Soil RAA 2.

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8.5 Soil RAA 5: In Situ Solidification/Stabilization

- Capital Cost: $1,200,000
- Annual O&M Cost: $16,000
- Soil RAA NPW: $1,400,000
- Time to Implement: Less than one year

Under Soil RAA 5, the contaminated soil exceeding the lead action limit of 400 mg/Kg will be mixed in situ with cement-based additives. The soil-cement mixture will set and form a solid, non-leaching matrix (similar to a concrete mass). Then a soil/clay (or clay equivalent) cover will be constructed over the solidified matrix and revegetated. Periodically, the cover will be visually inspected and patched as needed, and leaching tests will be conducted on the solidified matrix. Prior to the in situ treatment, treatability studies will be conducted to determine the appropriate mixture of solidifying agents and additives, the appropriate setting time, and the anticipated treatment results. This alternative also includes the same institutional controls, monitoring plan, and erosion control measures included under Soil RAA 2.

8.6 Soil RAA 6: Excavation and Soil Washing

- Capital Cost: $2,800,000
- Annual O&M Cost: $15,000
- Soil RAA NPW: $2,900,000
- Time to Implement: Less than six months

Under Soil RAA 6, the contaminated soil exceeding the lead action limit of 400 mg/Kg will be excavated and sent through an on-site treatment unit where it will undergo soil washing and soil leaching (i.e., acid leaching) treatment. The excavation area will be backfilled with treated, clean soil. The recovered lead will be reused at a lead smelter facility, and the washwater and acid will be sent for further treatment. Prior to treatment, treatability studies will be conducted to determine the appropriate mixture of washing agents and additives, and the anticipated treatment results. This alternative also includes the same institutional controls, monitoring plan, and erosion control measures included under Soil RAA 2.

9.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

This section summarizes the comparative analysis of the RAAs developed for the contaminated soil in Area A (OU III). The comparative analysis was based on the following nine evaluation criteria: overall protection of human health and the environment; compliance with ARARs; long-term effectiveness/permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; cost; acceptance by the Commonwealth of Virginia; and acceptance by the public. Table 9-1 provides definitions for several of these evaluation criteria. Table 9-2summarizes the RAA evaluation using seven of the evaluation criteria. The last two criteria, Commonwealth of Virginia acceptance and public acceptance are evaluated in Sections 9.8 and 9.9.

9.1 Overall Protection of Human Health and the Environment

Under Soil RAAs 1 and 2, no remediation actions will be implemented to remove, treat, or isolate the contaminated soil. Human and ecological receptors may potentially have direct contact with Area A soil contamination which is located at highly accessible depths (0 to 4 feet bgs). Soil RAA 2 provides some restrictions on the amount of access that human receptors may have. These restrictions include institutional controls that will limit future land use, long-term surface water monitoring that will monitor the migration of contaminants from Area A, and erosion control measures that will mitigate the erosion of contaminated soil. However, these restrictions will only mitigate, not completely eliminate, the potential for direct human exposure and does not address potential exposure potential.

Like Soil RAAs 1 and 2, Soil RAA 3 allows the contaminated soil to remain untreated on site. However, Soil RAA 3 includes a soil/clay (or clay equivalent) cover that will effectively prevent erosion and contaminant migration to Ballard Creek as well as isolate the contaminated soil from human and ecological receptors. Thus, Soil RAA 3 will more effectively reduce potential human health and ecological risks compared to Soil RAAs 1 and 2. Soil RAA3 4, 5, and 6 will also effectively reduce potential risks to humans and ecological receptors by treating and/or disposing of the contaminated soil. However, complete removal and treatment of the contaminated soil is not necessary to provide adequate protection to human health and the environment.

TABLE 9-1

GLOSSARY OF EVALUATION CRITERIA
SITE 12, BARRACKS ROAD LANDFILL
WPNSTA YORKTOWN, YORKTOWN, VIRGINIA

- Overall Protection of Human Health and the Environment - addresses whether or not an alternative provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment engineering or institutional controls

- Compliance with ARARs/TBCs - addresses whether or not an alternative will meet all of the applicable or relevant and appropriate requirements (ARARs), other criteria to be considered (TBCs), or other Federal and state environmental statutes and/or provide grounds for invoking a waiver.

- Long-term Effectiveness and Permanence - refers to the magnitude of residual risk and the ability of an alternative to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

- Reduction of Toxicity, Mobililty, or Volume Through Treatment - refers to the anticipated performance of the treatment options that may be employed in an alternative.

- Short-term Effectiveness - refers to the speed with which the alternative achieves protection, as well as the remedys potential to create adverse impacts on human health and the environment that may result during the construction and implementation period.

- Implementability - refers to the technical and administrative feasibility of an alternative, including the availability of materials; and services needed to implement the chosen solution.

- Cost - includes capital and operation and maintenance costs. For comparative purposes, provides present worth values.

TABLE 9-2

SUMMARY OF THE SOIL RAA EVALUATION
SITE 12, BARRACKS ROAD LANDFILL
WIPNSTA YORKTOWN, YORKTOWN, VIRGINIA

Evaluation Criteria	Soil RAA 1 No Action	Soil RAA 2 Institutional Controls, Monitoring, and Erosion Control	Soil RAA 3 Soil and Clay Cover	Soil RAA 4 Excavation and Landfill Disposal	Soil RAA 5 In Situ Solidification/ Stabilization	Soil RAA 6 Excavation and Soil Washing
OVERALL PROTECTIVENESS						
ò Human Health	No protection.	Low level of protection that may not be adquate considering the shallow depths (0 to 4 feet bgs)at which contaminants are located.	Adequate level of protection.	High level of protection.	High level of protection.	High level of protection.
ò Environmental	No protection.	Low level of protection that may not be adequate considering the shallow depths (0 to 4 feet bgs)at which contaminants are located.	Adequate level of protection.	High level of protection.	High level of protection.	High level of protection.
COMPLIANCE WITH ARARs						
ò Chemical-Specific ARARs/TBCs	Not applicable to soil.	Not applicable to soil.	Not applicable to soil.	Not applicable to soil.	Not applicable to soil.	Not applicable to soil.
ò Location-Specific ARARs	Not applicable.	Not applicable.	Can be designed to meet location-specific ARARs.	Can be design to meet location-specific ARARs.	Can be design to meet location-specific ARARs.	Can be design to meet location-specific ARARs.
ò Action-Specific ARARs ARARs	Not applicable.	Not applicable.	Can be designed to meet location-specific ARARs.	Can be design to meet location-specific ARARs.	Can be design to meet location-specific ARARs.	Can be design to meet location-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERFORMANCE						
ò Magnitude of Residual Risk.	No reduction in risks.	Minimal risk reduction.	Significant risk reduction.	Significant risk reduction.	Significant risk reduction.	Significant risk reduction.
ò Adequacy and Reliability of Controls	Not applicable-no controls.	Controls will be reliable, but may not be adequate.	Adequate and reliable controls.	Adequate and reliable controls.	Adequate and reliable controls.	Adequate and reliable controls.
ò Need for 5-year Review	Review will be required to ensure adequate protection of human health and the environment.	Review will be required to ensure adequate protection of human health and the environment.	Review will be required to ensure adqute protection of human health and the environment.	Review will not be required for OU III. Will be required for OU IV.	Review will be required to ensure adequate protection of human health and the environment.	Review will not be required for OU III. Will be required for OU IV.

TABLE 9-2 (Continued)

SUMMARY OF THE SOIL RAA EVALUATION
SITE 12, BARRACKS ROAD LANDFILL
WIPNSTA YORKTOWN, YORKTOWN, VIRGINIA

Evaluation Criteria	Soil RAA 1 No Action	Soil RAA 2 Institutional Controls, Monitoring, and Erosion Control	Soil RAA 3 Soil and Clay Cover	Soil RAA 4 Excavation and Landfill Disposal	Soil RAA 5 In Situ Solidification/ Stabilization	Soil RAA 6 Excavation and Soil Washing
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT						
ò Treatment Process Used	No treatment process.	No treatment process.	No treatment process.	No treatment process.	In situ solidification/ stabilization.	Soil washing and acid leaching.
ò Amount Destroyed or Treated.	None.	None.	None.	None.	The majority of the contamination will be treated.	The majority of the contamination will be treated.
ò Reduction of Toxicity, Mobility, or Volume Through Treatment	None.	None.	None.	Reduction in toxicity, mobility, and volume of the soil contaminants.	Reduction in mobility of the soil contaminants.	Reduction in toxicity, mobility, and volume of the soil contaminants.
ò Residuals Remaining After Treatment.	Not applicable-no treatment.	Not applicable-no treatment.	Not applicable-no treatment.	Not applicable-no treatment.	The solidified/stabilized matrix.	Clean soil.
ò Statutory Preference for Treatment	Not satisfied.	Not satisfied.	Not satisfied.	Not satisfied.	Satisfied.	Satisfied.
SHORT-TERM EFFECTIVENESS						
ò Community Protection	Potential risks to the community will not be increased.	Potential risks to the community will be increased, but these risks will be minimal and easy to control.	Potential risks to the community will be increased, but these risks will be minimal and easy to control.	Potential risks to the community will be increased, but these risks will be controlled.	Potential risks to the community will be increased, but these risks will be controlled.	Potential risks to the community will be increased, but these risks will be controlled.
ò Worker Protection	No risks to workers.	Potential risks to workers will be minimal and easy to control.	Potential risks to workers will be minimal and easy to control.	Potential risks to workers will be easy to control.	Potential risks to workers will be easy to control.	Potential risks to workers will be easy to control.
ò Environmental Impact	No additional environmental impacts.	No additional environmental impacts.	No additional environmental impacts.	No additional environmental impacts.	No additional environmental impacts.	No additional environmental impacts.
ò Time Until Action is Complete	Not applicable.	Less than six months.	Less than one year.	Less than one year.	Less than one year.	Less than six months.

TABLE 9-2 (Continued)

SUMMARY OF THE SOIL RAA EVALUATION
SITE 12, BARRACKS ROAD LANDFILL
WIPNSTA YORKTOWN, YORKTOWN, VIRGINIA

Evaluation Criteria	Soil RAA 1 No Action	Soil RAA 2 Institutional Controls, Monitoring, and Erosion Control	Soil RAA 3 Soil and Clay Cover	Soil RAA 4 Excavation and Landfill Disposal	Soil RAA 5 In Situ Solidification/ Stabilization	Soil RAA 6 Excavation and Soil Washing
IMPLEMENTABILITY						
ò Ability to Construct and Operate	No construction or operation activities.	Steep terrain will complicate construction. complicate construction.	Steep terrain and loose, uncompacted ash material will complicate construction.	Steep terrain and loose, uncompacted ash material will complicate construction.	Steep terrain and loose, uncompacted ash material will complicate construction. Debris and subsurface heterogeneities may inhibit the in situ mixing process.	Steep terrain and loose, uncompacted ash material will complicate construction.
ò Ability to Monitor Effectiveness	No monitoring plan for measuring effectiveness.	Monitoring plan will measure the alternative's effectiveness.	Monitoring plan will measure the alternative's effectiveness.	Monitoring plan will measure the alternative's effectiveness.	Monitoring plan will measure the alternative's effectiveness.	Monitoring plan will measure the alternative's effectiveness.
ò Availability of Services and Capacities, Equipment	No services or equipment required.	Services and equipment should be readily available.	Serivces and equipment should be readily available.	Services and equipment should be readily available. Highly dependent on the availability of an off-site landfill.	Services and equipment should be readily available.	Services and equipment should be readily available.
ò Requirements for Agency Coordination	None required.	Must submit semiannual reports to document sampling.	Requires coordination with the Station Public Works/Planning Department. federal state acceptance of off-site facility is required; coordination with the Station Public Works/Planning Department.	Coordination with the Department of Transportation for off-site transport of soils;	Requires coordination with the Station Public Works/Planning Department.	Requires coordination with the Station Public Works/Planning Department.
COST(Net Present Worth)	$0	$680,000	$1,100,000	$4,800,000	$1,400,000	$2,900,000

Based on this information, Soil RAA 1 provides no protection of human health and the environment, Soil RAA 2 provides a low level of protection that may not be adequate considering the shallow depths at which the contaminants are located, Soil RAA 3 provides an adequate level of protection, and Soil RAAs 4, 5, and 6 provide a high level of protection that is not necessary.

9.2 Compliance with ARARs

Because chemical-specific ARARs have not been promulgated for contaminants in soil, an evaluation of compliance with chemical-specific ARARs is not necessary. No action-specific or location-specific ARARs apply to Soil RAAs 1 and 2. Action-specific and location-specific ARARs do apply to Soil RAAs 3, 4, 5, and 6; these alternatives can be designed to meet all applicable ARARs. The following action-specific ARARs (or portions of these ARARs) apply: RCRA Subtitle C, National Ambient Air Quality Standards, Virginia Solid Waste Management Regulations, Toxic Substance Control Act (TSCA) - PCB Spill Cleanup Policy, Virginia Hazardous Waste Regulations, Landfill Closure and Post-Closure Care, Virginia Stormwater Management and Erosion and Sediment Control Regulations, and Virginia Ambient Air Quality Standards.

9.3 Long-Term Effectiveness and Permanence

Soil RAA 1 does not provide long-term effectiveness and permanence. This is because Soil RAA 1 allows human and ecological receptors to have unlimited exposure to the contaminated soil. Like Soil RAA 1, Soil RAA 2 allows the contaminated soil to remain untreated on site. However, Soil RAA 2 includes institutional controls, long-term monitoring, and erosion control measures to manage the soil contaminants. Regardless, the contaminants are located at such shallow, accessible depths (0 to 4 feet bgs) that Soil RAA 2 will only provide limited effectiveness and permanence.

Soil RAAs 3, 4, 5, and 6, on the other hand, provide higher levels of effectiveness and permanence by either eliminating or further mitigating the potential soil risks associated with Area A. The effectiveness of Soil RAAs 3 and 5, however, is extremely dependent on the effectiveness of long-term maintenance of the soil/clay (or clay equivalent) cover and/or the solidified matrix.

9.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Soil RAAs 1, 2, 3, and 4 do not involve treatment processes so these alternatives will not reduce toxicity, mobility, or volume of the soil contamination through treatment, nor will these alternatives satisfy the statutory preference for treatment. Soil RAAs 5 and 6 involve treatment processes so these alternatives will satisfy the statutory preference for treatment. Under Soil RAA 5, the treatment process (solidification/stabilization) will reduce the mobility of the soil contaminants. Under Soil RAA 6, the treatment process (soil washing) will reduce the mobility, toxicity, and volume of the soil contaminants.

9.5 Short-Term Effectiveness

Implementafion of Soil RAA 1 does not increase risks to the community or to workers because no actions will be taken. Soil RAAs 2 and 3 may slightly increase risks during the periodic sampling events and during construction of the rip rap and vegetative matting, but these risks will be minimal and easy to control. Soil RAA 3 may further increase risks during construction of the soil/clay (or clay equivalent) cover, but these risks will also be minimal and relatively easy to control. Soil RAAs 4, 5, and 6 will present the most short-term risks because they involve extensive soil excavation and backfilling, activities. In addition, Soil RAAs 5 and 6 include treatment processes, and Soil RAA 4 includes transportation of the contaminated soil, which will necessitate extensive handling of the contaminated material.

9.6 Implementability

Soil RAA 1 is the most implementable alternative. Soil RAA 2 is the next most implementable alternative because it only involves surface water sampling and construction of rip rap and vegetative matting. The remaining RAAs (Soil RAAs 3, 4, 5, and 6) are not as easily implemented because they involve cover construction, soil excavation and backfilling, transportation of contaminated materials, and/or treatment processes. The implementability of all of the alternatives, with the exception of Soil RAA 1, will be impacted by the steep terrain located along the stream channel at Area A. This will complicate the construction of rip rap and vegetative matting and excavation/backfilling activities. Some steep areas may be inaccessible to conventional construction equipment. In addition, construction and excavation activities will be difficult in areas that contain loose, uncompacted ash material. Under Soil RAA 5, in situ soil mixing may be inhibited by the debris that is located within Area A and by subsurface heterogenities.

With the exception of Soil RAA 1, all of the alternatives will require extensive coordination with the Station Environmental Directorate, Public Works/Planning Department. Soil RAA 4 will also require coordination with the Department of Transportation and Commonwealth and Federal acceptance of the off-site disposal facility. All required services, materials, and/or technologies should be readily available under all six alternatives.

9.7 Cost

In terms of NPW, the no action alternative (Soil RAA 1) would be the least expensive RAA to implement, followed by Soil RAA 2 , Soil RAA 3, Soil RAA 5, Soil RAA 6, and then Soil RAA 4. The estimated NPW values, in increasing order, are

- $0 (Soil RAA 1: No Action)
- $680,000 (Soil RAA 2: Institutional Controls, Monitoring, and Erosion Control)
- $1,100,000 (Soil RAA 3: Soil/Clay [or clay equivalent] Cover)
- $1,400,000 (Soil RAA 5: In Situ Solidification/Stabilization)
- $2,900,000 (Soil RAA 6: Excavation and Soil Washing)
- $4,800,000 (Soil RAA 4: Excavation and Off-Site Landfill Disposal)

These costs do not include the cost associated with a long-term monitoring program for OU V. Assuming that a minimum of nine existing wells, three newly installed wells and seven surface water/sediment locations will be sampled semi-annually over a thirty year period, a net present worth cost of $1,174,000 was derived. This cost will be refined as a long-term monitoring work plan is developed by the Navy, USEPA Region III and the Commonwealth of Virginia (see Appendix B).

9.8 Commonwealth Acceptance

The Commonwealth of Virginia concurs with the remedy selected for Site 12, namely: Soil RAA 3 (Soil/Clay [or clay equivalent] Cover) for contaminated soil in Area A (OU III); no action for the soils in Area B/C and Wood Debris Area (OU IV); and property use restrictions, along with long-term monitoring, for Site 12 groundwater and Ballard Creek surface water and sediments (OU V).

9.9 Community Acceptance

The DoN solicited input from the public on the remedial action alternatives described in this ROD, and held a public meeting to hear the community's concerns. Based on comments received, the public appears to support the selected remedy. The public's questions and comments, and DoN's responses, are presented in the Responsiveness Summary at the end of this ROD, and the transcript of the public meeting, is presented in Appendix B.

10.0 THE SELECTED REMEDY

This section of the ROD presents the selected remedy for Site 12. The following information is presented: a remedy description, which includes the rationale behind the remedy selection; the performance standards to be attained at the conclusion of the remedy; and the costs estimated to implement the remedy.

10.1 Remedy Description

The selected remedy for Site 12 includes Soil RAA 3: Soil/Clay (or clay equivalent) Cover for OU III, no action for OU IV, and a long-term groundwater, surface water, and sediment monitoring program for OU V. (Figure 8-1 depicts Soil RAA 3). Thus, the selected remedies will include the following:

OU III - Area A Soil

- Excavating the soil and the removal of debris located on steep slopes, spreading excavated soil over flat portions of Area A, and backfilling the excavated area with clean soil.

- Placing and compacting 12 inches of clay or a material with similar permeability over the resulting soil pile (approximately 7,400 square yards). Placing and compacting six inches of topsoil over the clay/clay equivalent material.

- Construction of erosion control along the steep slopes located along the stream channel within Area A.

- Implementing land use restrictions in the Station Master Plan and long-term monitoring of surface water at Area A.

OU IV - Area B/C, Wood/Debris Disposal Area Soils

- No Action

OU V - Groundwater Ballard Creek Surface Water and Sediments

- Implementing property/aquifer use restrictions throughout Area A, Area B/C and the Wood/Debris Disposal Area in the Station Master Plan to ensure that groundwater at Site 12 is not used as a drinkable source.

- Implementing long-term monitoring of groundwater from shallow and deep wells across the study area, and surface water and sediment from Ballard Creek and its tributaries. The details of this monitoring program (e.g., sampling locations, frequency, and analyses) will be identified in a long-term monitoring work plan, a primary document in the FFA.

10.1.1 The Selection of Soil RAA 3: Soil/Clay (or clay equivalent) Cover for OU III

Based on the results of the alternative evaluation, Soil RAA 3: Soil/Clay (or clay equivalent) Cover was selected as the remedy for the contaminated soil at Area A (OU III) because it provides the most appropriate, cost-effective level of protection considering the nature of the contamination. Because the contaminated soil is located at shallow, highly accessible depths (from 0 to 4 feet bgs), a physical barrier to prevent erosion and direct exposure is necessary. A soil/clay (or clay equivalent) cover will provide such a barrier, provided it is maintained over time, the cover will effectively isolate the contaminated soil. Soil RAAs 4, 5, and 6 (Excavation and Off-Site Disposal, In Situ Solidification/ Stabilization, and Excavation and Soil Washing) may also prevent erosion and direct exposure by actively removing, treating, or disposing of the contaminated soil. However, these RAAs are not as easily implemented, and/or do not provide in increase with respect to cost benefit compared to the soil/clay (or clay equivalent) cover alternative. Soil RAA 4 requires excavation/transportation/backfilling of approximately 11,000 cubic yards of contaminated soil, Soil RAA 5 requires in situ mixing which may be impeded by subsurface obstructions and heterogenities, and Soil RAA 6 requires mobilization of an on-site soil washing system and excavation/treatment/backfilling of approximately 11,000 cubic yards of soil. Soil RAA 3 only requires the construction of a 12 inch soil/clay (or clay equivalent) cover over approximately a 7,400 square yard area. In addition, the costs estimated for Soil RAAs 4, 5, and 6 ($4.8 million, $1.4 million, and $2.9 million, respectively) exceed the cost estimated for Soil RAA 3 ($1.1 million).

10.1.2 The Selection of the No Action Alternative for OU IV

RAAs were not proposed for Area B/C soil and Wood/Debris Disposal Area soil (OU IV) because of the limited risk to human health and ecological receptors by soil COCs in these areas. As such, the No Action Alternative was selected.

10.1.3 The Selection of Institutional Controls and a Long-Term Groundwater, Surface Water, and Sediment Monitoring Program for OU V

As explained earlier in this ROD, the risks associated with groundwater at Site 12 are within acceptable limits as long as people do not drink the groundwater. Although COCs were detected in Ballard Creek's surface water and sediment, they do not pose unacceptable risks to human health or the environment. The levels of contamination are low, and treatment of the sediment would require dredging that would be more harmful to the environment than the presence of the contamination.

For these reasons, the PRAP for this Site recommended that no remedial action be taken with respect to the groundwater at Site 12 or the surface water and sediment of Ballard Creek. The Proposed Plan did recommend, however, a long-term monitoring program for the groundwater, surface water and sediment.

In response to USEPA's comments on the PRAP, the original proposal was modified. The remedy for Site 12 groundwater now includes institutional controls (i.e., land use restrictions) to ensure that the groundwater is not used as a drinking water source. In addition, the DoN will perform long-term monitoring of Site 12 groundwater and Ballard Creek's surface water and sediment. Long-term monitoring will help to ensure that the groundwater quality and surface water/sediment quality do not further deteriorate. This monitoring program will be implemented in addition to the long-term monitoring specified for Area A (OU III) under Soil RAA 3. The OU V monitoring program will include periodic sampling and analysis of groundwater in the Cornwallis Cave (shallow) and Yorktown-Eastover (deep) aquifers, surface water and sediment in Ballard Creek. Fish tissue and/or sediment toxicity testing may also occur. The details of the program (e.g., sampling locations, frequency, duration, and analyses) will be identified in a long-term monitoring work plan. If the monitoring program indicates that groundwater, surface water, or sediment quality is deteriorating, remediation of these media may be reconsidered. Results of long-term monitoring will be evaluated as part of the five year review to determine whether the response action is protective of human health and the environment, analyze newly promulgated or modified requirements of Federal or Commonwealth of Virginia environmental laws to determine if they are ARARs and potential changes to monitoring indicators.

10.2 Performance Standards

10.2.1 Soil/Clay (or clay equivalent) Cover and Erosion Control Measures

The soil/clay (or clay equivalent) cover and erosion control measures will be constructed for OU III to the following performance standards.

The soil/clay (or clay equivalent) cover will minimize erosion and potential infiltration of precipitation. The cover will consist of 12 inches of compacted clay or a similar material which provides an in-place permeability similar to 12 inches of compacted clay. Six inches of topsoil will be placed on top of the clay or clay equivalent to sustain a vegetative cover.

Erosion control measures may also include the construction of rip rap and the addition of clean fill material lining the entire length of the Area A stream channel that discharges to Ballard Creek.

The soil/clay (or clay equivalent) cover and erosion control measures described in RAA 3 are intended to limit the potential for erosion of organic and inorganic contaminants detected in Area A to Ballard Creek. RAA 3 will also prevent the direct contact of contaminated Area A soils by current human, terrestrial, and aquatic receptors. The extent of the cover will be sufficient to cover contaminated soils containing lead concentrations of 400 mg/Kg or greater. The extent of the cover will also address soil exhibiting PCB contamination exceeding the TSCA-PCB Spill Cleanup Policy Clean Soil value of 1.0 mg/Kg total PCBs. The 400 mg/Kg lead value is an USEPA action limit for soil lead derived using the UBK model. Because elevated lead levels are associated with the presence of ash and affected soils at Area A, this RL is protective of both human health and aquatic and terrestrial ecological receptors. Table 10-1 presents COCs and corresponding RL values for Area A soils which will be addressed by RAA 3.

Long-term monitoring and five year reviews will be conducted as part of RAA 3 (as per the NCP) to determine that the remedy prevents erosion of soil-borne contaminants and precludes direct contact by humans and ecological receptors. Five year reviews are intended to evaluate whether the response action remains protective of public health and the environment. The review will consist of a review of documented operations, maintenance of the site, review of long-term monitoring results, analysis of newly promulgated or modified requirements of Federal or Commonwealth of Virginia environmental laws to determine if they are ARARs and possibly a site visit. A further objective of the five year review is to consider the scope of O&M for the cover at Area A, the frequency of repairs, potential changes in monitoring indicators, costs and how overall actions relate to protectiveness.

10.21 Long-Term Monitoring

Shallow and deeper groundwater, and Ballard Creek surface water and sediments (OU V) will be subjected to long-term monitoring.

Long-term monitoring will be conducted to determine the potential impact of TCE in shallow groundwater on deeper groundwater and the water quality of Ballard Creek. Groundwater monitoring will be conducted and will require reviews of a minimum of every 5 years as per the NCP. Ballard Creek surface water and sediments will be monitored as agreed to by the parties to determine temporal effects on the concentration of COCs. Fish tissue and/or toxicity testing may also be considered as part of the surface water and sediment monitoring effort.

Monitoring of groundwater and surface water will be conducted to assure that surface water concentrations of

TCE in Ballard Creek proper do not exceed the Virginia Water Quality Standard for surface water of 807Ig/L. Again, because of the future land use restrictions associated with contamination in groundwater, groundwater will be monitored with reviews occurring at a minimum every 5 years as per the NCP. Surface water and sediment monitoring of Ballard Creek will be conducted as agreed to by the parties. Table 10-2 presents ecological COCs and trigger values pertinent to the long-term monitoring effort for OU V. Exceedence of trigger values could result in the reevaluation of the selected remedy.

TABLE 10-1

AREA A SOIL REMEDIATION LEVELS
SITE 12 - OPERABLE UNIT NUMBER III
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Chemical of Concern	Maximum Detected Concentration (mg/Kg)	Human Health RL (mg/Kg)	Basis of Goal
1,3,5-Trinitrobenzene	3.7	6	Protection of Human Health/Current land use scenario
Antimony	28.5L	170	Protection of Human Health/Current land use scenario
Cadmium	25.7	65	Protection of Human Health/Current land use scenario. RAA 3 also protects ecological receptors/Prevent potential erosion to Ballard Creek
Manganese	1,230	3,000	Protection of Human Health/Current land use scenario
Lead	9,100(1)	400*	Protection of Human Health/Current land use scenario. RAA 3 also protects ecological receptors/Prevent potential erosion to Ballard Creek

Notes:

(1) Obtained from a shallow subsurface soil sample.
Human Health RLs derived using a current land use (i.e., trespasser scenario) unless otherwise noted.
mg/Kg - milligrams per kilogram
* - Lead action level derived from UBK model.
RL - Remediation Level

TABLE 10-2

LONG-TERM MONITORING TRIGGER VALUES
SITE 12 - OPERABLE UNIT NUMBER V
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Chemical of Concern	Medium of Concern	Trigger Value	Basis
Trichloroethene	Groundwater	16,000 ɪg/L	Risk/Beneficial Use Scenario
Trichloroethene	Surface Water	807 ɪg/L	VDEQ - WQC
PAHs	Sediment	NA	TBD
PCBs	Sediment	NA	TBD
Cadmium	Sediment	NA	TBD
Manganese	Sediment	NA	TBD
Silver	Sediment	NA	TBD
Antimony	Sediment	NA	TBD
Beryllium	Sediment	NA	TBD

Notes:

NA = Not Available
TBD = To be determined during the development of the long-term, monitoring work plan
VDEQ = Virginia Department of Environmental Quality
WQC = Water Quality Criterion for the protection of human health at ICR = 1 x 10-04
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs - Polychlorinated Biphenyls
ug/L = micrograms per liter

10.3 Estimated Costs

The following costs were estimated for the Soil RAA 3: Soil/Clay (or clay equivalent) Cover

- Capital Cost: $740,000 (includes cover and erosion control measures)
- Annual O&M Cost: $21,000 (includes 30 years of cover maintenance and 30 years of surface water monitoring at 4 locations)
- Net Present Worth: $1,100,000

The following costs were estimated for the long-term monitoring program for OU V:

- Capital Cost: $30,300 (includes installation of 3 new wells)
- Annual O&M Cost: $74,400 (includes 30 years of semi-annual monitoring)
- Net Present Worth: $1,174,000

The actual cost associated with the long-term monitoring program for OU V will be established in the long-term monitoring work plan.

11.0 STATUTORY DETERMINATIONS

A selected remedy must satisfy the requirements of CERCLA, Section 121, including: protection of human health and the environment; compliance with ARARs; cost effectiveness; utilization of permanent solutions and alternative treatment technologies or resources recovery technologies to the maximum extent practicable; and preference for treatment that reduces toxicity, mobility, or volume as a principal element (or provide an explanation as to why this preference is not satisfied).

The evaluation of how the selected remedy for Site 12 satisfies these CERCLA requirements is presented below.

11.1 Protection of Human Health and the Environment

The selected remedy will provide overall protection of human health and the environment. Provided it is adequately maintained, the soil/clay (or clay equivalent) cover will prevent human and ecological receptors (with the exception of burrowing animals) from contacting the contaminated soil. Thus, the cover will alleviate the potential erosion of soil-borne contaminants and potential human and ecological risks. The alternative will provide additional protection by including institutional controls and long-term monitoring (for both OU III and OU V). The institutional controls will restrict future land use at Site 12 further mitigating the potential for direct exposure and potential risks. Similarly, the long-term monitoring programs will provide a warning mechanism against contaminant concentrations that may increase to levels above trigger concentrations. Thus, the monitoring programs will further mitigate the potential for direct exposure and potential risks. Finally, the erosion control measures will impede the erosion of contaminants from Area A. Thus, the potential for receptors located downstream of the site to contact eroded, contaminated soil will be mitigated. The selected remedy will entail a review by the lead agency every five years (as per the NCP) to ensure continued protection of human health and the environment.

11.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Because chemical-specific ARARs have not been promulgated for contaminants in soil, an evaluation of compliance with chemicai-specific ARARs is not necessary. However, to-be-considered (TBC) risk-based criteria were identified for contaminated soil. The selected remedy will comply with TBCs, which include the USEPA lead action level of 400 mg/Kg. This action level was obtained from the Revised Soil Lead Guidance for CERCLA Sites and Corrective Action Facilities (OSWER Directive 9355.4-12, July 14, 1994). It is a non-enforceable contaminant level intended as a guideline for cleanup of lead in soil. The selected remedy can also be designed to comply with all applicable action-specific and location-specific ARARs such as the TSCA-PCB Spill Cleanup Policy (see Tables 11-1 and 11-2).

11.3 Cost-Effectiveness

Capping of the lead-contaminated soil will provided a cost-effective remedy. Of the four RAAs that provide adequate protection to human health and the environment (Soil/Clay [or clay equivalent] Cover, Excavation and Off-Site Landfill Disposal; In Situ Solidification/Stabilization; and Excavation and Soil Washing), the Soil/Clay (or clay equivalent) Cover is the least expensive alternative. The NPW is approximately $1,100,000 compared to $1,400,000, $2,900,000, and $4,800,000 for the other three alternatives. Therefore, the Soil/Clay (or clay equivalent) Cover RAA is also the most cost-effective alternative.

11.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The selected remedy will present a permanent solution for Site 12. Provided they are adequately maintained over time, the soil/clay (or clay equivalent) cover, erosion control and vegetative matting, will present a permanent, long-term solution for the contaminated soil at Site 12. Provided they are enforced over time, the institutional controls will also present a permanent, long-term solution for potential exposure to contaminated soil. Finally, the long-term monitoring program (including surface water monitoring under Soil RAA 3, and groundwater, Ballard Creek surface water, and sediment monitoring under the OU V monitoring program) will provide a permanent, long-term solution for evaluating contaminant levels over time. The selected remedy, however, does not utilize alternative treatment technologies.

TABLE 11-1

LOCATION-SPECIFIC ARARs AND TBCs
FEASIBILITY STUDY, CTO-0311
SITE 12, BARRACKS ROAD LANDFILL
WPNSTA YORKTOWN, YORKTOWN, VIRGINIA

Citation	Requirement	ARAR/TBC Determination	Comments
FEDERAL/LOCATION-SPECIFIC			
The Endangered Species Act of 1973 (16 USC 1531) (40 CFR Part 502)	Requires action to conserve endangered and threatened species and their critical habitats.	Potentially applicable.	The Virginia Department of Environmental Quality (VDEQ) will be notified of this project and the Navy requests the involvement of the Virginia Board of Game and Inland Fisheries for determination of endangered species or habitats.
National Historic Preservation Act (32 CFR Parts 229 and 229.4; 43 CFR Parts 107 and 171.1-5)	Develops procedures for the protection of archaeological resources.	Applicable to any excavation on site. If archaeological resources are encountered during soil excavation, they must be reviewed by Federal and Commonwealth archaeologists.	Compliance can be met by submitting copies of work plans to the Virginia Department of Historic Resources (VDHR).
Groundwater Protection Strategy	EPA policy to protect groundwater for its highest present or potential beneficial use. The strategy designates three categories of groundwater: Class 1 - Special Ground Waters Class 2 - Current and Potential Sources of Drinking Water and Waters Having Other Beneficial Uses Class 3 - Groundwater Not a Potential Source of Drinking Water and of Limited Beneficial Use	TBC requirement.	Groundwater in the surficial aquifer is considered a Class 3.
Executive Order 11990, Protection of Wetlands; 40 CFR 6, Appendix A; excluding Sections 6(a)(2), 6(a)(4), 6(a)(6); 40 CFR 6.302	Action to minimize the destruction, loss or degradation of wetlands.	Relevant and appropriate.	Wetlands are present on and near the site and could potentially be impacted by remedial response actions.
The Flood Plain Standard 40 CFR 270.14(b)(II)(iii)	Information concerning the location of Site 12 with respect to the 100 year flood plain.	Potentially applicable.	

TABLE 11-1 (Continued)

LOCATION-SPECIFIC ARARs AND TBCs
FEASIBILITY STUDY, CTO-0311
SITE 12, BARRACKS ROAD LANDFILL
WPNSTA YORKTOWN, YORKTOWN, VIRGINIA

Citation	Requirement	ARAR/TBC Determination	Comments
STATE/LOCATION-SPECIFIC			
Virginia Wetlands Regulations (VR 450-01-0051)	Regulates activities that impact wetlands.	Potentially applicable to activities that could impact site wetlands.	Activities that could impact wetlands will comply with regulations.
Virginia Endangered Species Act and Virginia Board of Game and Inland Fisheries; Code of Virginia Sections 29.1-563 et seq. and 29-100 et seq.	Action to conserve endangered species or threatened species, including consultation with the Virginia Department of Game and Inland Fisheries, the Virginia Department of Agriculture and Consumer Services, and the Virginia Department of Conservation and Recreation.	Potentially applicable.	The Commonwealth will be notified of this project and the Navy request determination of endangered species or habitats from the Commonwealth.
Virginia Water Protection Permit Regulations (VR 680-15-01)	Delineates the procedures and requirements to be followed in connection with activities such as dredging, filling, or discharging any pollutant into, or adjacent to, surface waters, or any activity which impacts the physical, chemical, or biological properties of surface water (including wetlands).	Potentially applicable.	Serve as the Commonwealth's certification procedure related to the U.S. Army Corps of Engineers º404 Permit.
Chesapeake Bay Preservation Act, Code of Va. Sec. 10.1-2100 et seq., and the Chesapeake Bay Preservation Area Designation and Management Regulations (CBPA Regulations) (VR 173-02-01)	Requires that certain locally designated tidal and nontidal wetlands, as well as other sensitive land-disturbing activities, removal of land areas, be subject to limitations regarding vegetation, use of impervious cover, erosion and sediment control, storm water management, and other aspects of land use that may have effects on water quality.	Potentially applicable.	The CBPA requirements are administered by a local board.

TABLE 11-2

POTENTIAL ACTION-SPECIFIC ARARs AND TBCs
SITE 12, BARRACKS ROAD LANDFILL
WPNSTA YORKTOWN, YORKTOWN, VIRGINIA

Citation	Requirement	ARAR/TBC Determination	Comments
FEDERAL/ACTION-SPECIFIC			
DOT Rules for Hazardous Materials Transport (49 CFR Parts 107 and 171.1-500)	Regulates the transport of hazardous waste materials including packaging, shipping, and placarding.	Applicable for any action requiring off-site transportation of hazardous materials.	Remedial actions may include off-site treatment and disposal (e.g., off-site regeneration of activated carbon).
Resource Conservation and Recovery Act (RCRA) Subtitle C	Regulates the treatment, storage, and disposal of hazardous waste.	Applicable to remedial actions involving treatment, storage, or disposal of hazardous waste.	Remediation may involve treatment, storage, or disposal of hazardous waste.
Identification and Listing of Hazardous Waste (40 CFR Part 261)	Regulations concerning determination of whether or not a waste is hazardous based on characteristics or listing.	Applicable in determining waste classification.	Some site contaminants may be considered hazardous wastes.
Treatment, Storage, and Disposal (TSD) of Hazardous Waste (40 CFR Parts 262-265, 266)	Regulates the treatment, storage, and disposal of hazardous waste.	Applicable in the event that wastes on site are classified as hazardous.	TSD activities related to hazardous waste will comply with regulations.
Manifest Systems, Recordkeeping, and Reporting (40 CFR Part 264, Subpart E)	Regulates manifest systems related to hazardous waste treatment, storage, and disposal.	Applicable to remedial actions where hazardous waste is generated or transported.	Remedial actions may include off-site disposal or treatment.
Releases from Solid Waste Management Unites (40 CFR Part 264, Subpart F)	Regulates releases from solid waste management units.	All solid waste management units on site shall comply with requirements.	Groundwater protection standards apply to solid waste management units.
Use and Management of Containers (40 CFR Part 264, Subpart I)	Regulates use and management of containers being stored at all hazardous waste facilities.	Applicable to containers stored on site.	Remedial actions may generate containerized waste. Investigation-derived waste (IDW) is containerized.
National Emissions Standards for Hazardous Air Pollutants (NESHAPs) (40 CFR Part 61)	Standards promulgated under the Clean Air Act for significant sources of hazardous pollutants, such as vinyl chloride, benzene, trichloroethylene, dichlorobenzene, asbestos, and other hazardous substances. Considered for any source that has the potential to emit 10 tons of any hazardous air pollutant or 25 tons of a combination of hazardous air pollutants per year.	Applicable to releases or potential releases of hazardous pollutants. Remedial actions may result in release of hazardous air pollutants.	To be used during remedial design to determine that air emissions from the treatment facility will not exceed air emission standards.
Toxic Substance Control Act (TSCA) - PCB Spill Cleanup Policy (40 CFR Part 761)	Establishes the measure which EPA considers to be adequate cleanup for PCB contaminated sites.	Applicable to Area A where PCBs were detected in soil samples.	TSCA clean soil value of 1.0 mg/Kg (ppm) will be considered in the remedial design of the Area A cover

TABLE 11-2 (Continued)

POTENTIAL ACTION-SPECIFIC ARARs AND TBCs
SITE 12, BARRACKS ROAD LANDFILL
WPNSTA YORKTOWN, YORKTOWN, VIRGINIA

Citation	Requirement	ARAR/TBC Determination	Comments
FEDERAL/ACTION-SPECIFIC (continued)			
National Ambient Air Quality Standards (NAAQS) (40 CFR 50)	Standards for the following six criteria pollutants: particulates matter, sulfur dioxide; carbon monoxide; ozone; nitrogen dioxide; and lead. The attainment and maintenance of these standards are required to protect the public health and welfare.	TBC requirement.	TBC as treatment process could include one of the six criteria.
STATE/ACTION-SPECIFIC			
Virginia Solid Waste Management Regulations (VR 672-20-10)	Regulates the disposal of solid wastes.	Applicable for solid (nonhazardous) waste.	Remedial actions could include off-site disposal of nonhazardous waste.
Virginia Hazardous Waste Management Regulations (VR 672-10-1)	Regulates the treatment, storage, and disposal of hazardous waste.	Applicable to remedial actions involving treatment, storage, or disposal of hazardous waste.	Remediation may involve treatment, storage, or disposal of hazardous waste.
Identification and Listing of Hazardous Waste (VR 672-10-1, Part III)	Regulations concerning determination of whether or not a waste is hazardous based on characteristics or listing.	Applicable in determining waste classification.	Some site contaminants are considered listed wastes.
Releases from Solid Waste Management Units (VR 672-10, Part X, Section 10.5)	Regulates release from solid waste management units.	All solid waste management units on site shall comply with requirements.	Groundwater protection standards apply to solid waste management units.
Use and Management of Containers (VR 672-10, Part X, Section 10.8)	Regulates use and management of containers being stored at all hazardous waste facilities.	Applicable to containers stored on site.	Remedial actions may generate containerized waste. Investigation-derived waste (IDW) is containerized.
Landfill - Closure and Post-Closure Care	Provides closure and post-closure requirements for hazardous waste landfills.	May be relevant and appropriate to the Area A landfill (lead-contaminated soil). Applicable for hazardous waste landfills.	
Virginia Stormwater Management Regulations (VR 215-02-00) and Virginia Erosion and Sediment Control Regulations (VR 625-02-00)	Regulates stormwater management and erosion/ sedimentation control practices that must be followed during land disturbing activities.	Applicable for remedial actions involving land disturbing activities.	Activities during construction will comply with the Virginia Storm Water Management Program. A sediment and erosion control plan will be submitted to LANTDIV for approval.

Virginia Water Quality Standards (VR 680-21-00)	Surface water quality standards based on water use and criteria class of surface water.	Applicable to remedial actions requiring discharge to surface water.	Will be considered an ARAR used to determine the discharge limit from a remedial treatment facility.
Virginia Solid Waste Management Regulations (VR 672-20-10)	Regulates the disposal of solid wastes.	Applicable for solid (nonhazardous) waste.	Remedial actions could include off-site disposal of nonhazardous waste.

11.5 Preference for Treatment as a Principal Element

The selected remedy does not satisfy the statutory preference for treatment as a principal element. Treatment technologies for the contaminated soil at Site 12 were evaluated and screened during the FS. However, these technologies were considered unnecessary in order to provide adequate protection to human health and the environment. Long-term monitoring of groundwater and restrictions of future property use will ensure the protection of human health and ecological receptors at Site 12. Covering the contaminated soil with a soil/clay (or clay equivalent) cover will prevent erosion of soil-borne contaminants and direct contact by both human and ecological receptors to contamination at a reasonable cost. In addition, vegetative matting will prevent further erosion of contaminated Area A soil.

RESPONSIVENESS SUMMARY

The Final Proposed Remedial Action Plan (June 1996) originally addressed two OUs: OU III - Area A soil; and OU IV - Area B/C soil, Wood/Debris Disposal Area soil, and Ballard Creek surface water and sediment.

The preferred alternative for OU III was to construct a soil/clay (or clay equivalent) cover over lead-contaminated soil at Area A. A long-term monitoring program was proposed for OU IV, the details of which would be identified in a Long-Term Monitoring Work Plan. Long-term monitoring was recommended to ensure that further deterioration of groundwater quality and Ballard Creek would not occur.

In response to comments from USEPA Region III, groundwater and Ballard Creek surface water and sediment (which could potentially be affected by groundwater) were addressed as an OU (OU V) separate from Area B/C soil and Wood/Debris Disposal Area soil (OU IV). As such, restrictions on future land use associated with contaminated groundwater could be instituted to ensure that groundwater is not used as a drinking water source. These changes were discussed at the July 26, 1996 public meeting (pages 41 through 43 of the transcript provided in Appendix B).

In this ROD, Site 12 has been subdivided into three OUs. Site 12 OUs include:

OU III - Area A soil;

OU IV - Area B/C and Wood/Debris Disposal Area Soils and;

OU V - Groundwater, Ballard Creek Surface Water and Sediments.

No action is specified for OU IV and groundwater use restrictions, along with long-term monitoring is specified for OU V. Under the long-term monitoring program specified for OU V groundwater will be monitored with reviews occurring at a minimum of every 5 years as per the NCP. A review every five years as per the NCP is required because future use of the property at Site 12 will be restricted because of contamination that will remain on site in shallow groundwater. Surface water and sediments in Ballard Creek will be monitored as agreed to by the parties. The details of the long-term monitoring program will be established during the development of a long-term monitoring work plan, a primary document under the WPNSTA Yorktown FFA.

The selected remedy for OU III is the placement of a soil/clay (or clay equivalent) cover over contaminated Area A soils. This remedy will prevent potential migration of contaminants via erosion to Ballard Creek and will preclude direct contact of soil-borne contaminants by potential human and ecological receptors. The use of clay or some material of similar permeability will also limit the potential downward movement of soil-borne contaminants by limiting infiltration of precipitation.

Based on comments received from the audience at the Public Meeting July 26, 1996, the public appears to support the aforementioned alternative. No written comments were received during the 45 day public comment period.

The transcript of the Public Meeting is provided in Appendix C.

APPENDIX A

EXTENT OF GROUNDWATER CONTAMINATION

FIGURES A.1 THROUGH A.8

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<IMG 97181QP>
<IMG 97181QQ>
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<IMG 97181 QV>

APPENDIX B

REMEDIAL ACTION ALTERNATIVES FOR GROUNDWATER

DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES FOR GROUNDWATER

If long-term monitoring of groundwater, surface water, and sediment across the entire Site 12 study area indicates an increase in contaminant levels, a contingency plan involving active remediation may be implemented for these media. Most likely, remediation of TCE-contaminated shallow groundwater will occur since it is believed to be the source of surface water and sediment contamination. For contingency purposes, three remedial action alternatives (RAAs) have been developed for groundwater:

- Pump and Treat
- In-Well Aeration
- Air Sparging and Soil Vapor Extraction

All three alternatives include long-term groundwater, surface water, and sediment monitoring and assumptions about sampling locations, frequency, and analyses were made for cost estimating purposes only. Table F-1 presents a cost for the long-term monitoring program alone, and Figure F-1 presents the assumed sampling locations.

The following subsections present conceptual system designs for the three groundwater alternatives.

Pump and Treat

Under the pump and treat alternative, groundwater will be collected by extraction wells, transported to an on-site treatment plant for VOC removal, then discharged to an on-site drainage way that eventually flows into Ballard Creek.

Since pump tests have never been conducted at Site 12 or in the industrial area, there is no conclusive way to determine the pumping rate and radius of influence for an extraction well in these locations. In lieu of a pump test, the pumping rate and radius of influence were estimated based on slug test data, the site geology, and the site hydrogeology. The pumping rate was estimated to be 5 gpm and the radius of influence was estimated to be 150 feet. These estimates were made to assist in developing a conceptual system layout and cost estimate. The estimations were not intended to be used as design parameters.

Based on the estimated radius of influence and pumping rate, 11 extraction wells will be installed to collect groundwater from the surficial aquifer as shown in Figure F-2. Five of the wells will be arranged in a downgradient row to contain the plume and provide a barrier against contaminant migration into Ballard Creek. The other wells will be arranged to extract and the treat the "hot" portions of the plume. Each extraction well will be screened near the confining unit, approximately 50 feet bgs.

After being extracted, the groundwater will be transported by pipeline to an on-site treatment plant. At the treatment plant, the groundwater will undergo suspended solids and metals removal via neutralization, precipitation, flocculation, sedimentation, and filtration units, and VOC treatment via a low profile air stripper. After receiving treatment, groundwater will be discharged to the Site 12 stream channel that runs through Area A and discharges into Ballard Creek.

Table F-2 presents a cost estimate for the pump and treat alternative. For cost estimating purposes, 30 years of system operation were assumed. The cost estimate also includes the proposed monitoring plan for surface water, sediment, and groundwater.

In-Well Aeration

In-well aeration is a type of air sparging in which air is injected into a well creating an in-well air-lift pump effect. This pump effect causes the groundwater to flow in a circulation pattern: into the bottom of the well and out of the top of the well. As the groundwater circulates through the well, the injected air stream strips volatiles. (As a result, in-well aeration is often referred to as in- well air stripping.) The volatiles are captured at the top of the well and treated via a carbon adsorption unit.

The in-well aeration system for Site 12 and the Industrial Area will contain 20 aeration wells with overlapping radii of influence as shown in Figure F-3. The approximate radius of influence for each well has been estimated to be 75 feet. This estimate, made by a technology vendor, was based on site-specific geologic and hydrogeologic parameters. Eight of the wells will be arranged in a downgradient row to contain the plume and provide a barrier against contaminant migration into Ballard Creek. The other wells will be arranged to treat "hot" portions of the plume.

A separate vacuum pump, knockout tank, and carbon adsorption unit will be located near the opening of each aeration well. The knockout tank will remove any liquids that may have traveled up the well (the amount of knockout liquid will be minimal) and the carbon adsorption unit will treat off-gases that were stripped within the well. Treated vapors from the carbon adsorption unit will be discharged to the atmosphere.

Because in-well aeration is a relatively new and innovative technology, a field pilot test is recommended prior to initiating the system design. The pilot test will determine the loss of efficiency over time as a result of inorganics precipitation and oxidation on the well screen, the radius of influence of the aeration wells under various heads of injection air pressure, the rate of off-gas organic contaminant removal via carbon adsorption, and carbon breakthrough times.

Table F-3 presents a cost estimate for the in-well aeration alternative. The cost estimate also includes the proposed monitoring plan for surface water, sediment, and groundwater.

Air Sparging and Soil Vapor Extraction

Air sparging involves the injection of air into a well that is installed to the base of the contaminated aquifer. The injected air exists through the well screen and moves outward and upward through the saturated zone. As the air moves through the aquifer, it volatilizes dissolved contaminants and enhances natural subsurface biodegradation. The volatilized contaminants may then be captured in the vadose zone by an SVE well and treated via vapor-phase activated carbon.

The air sparging/SVE system for Site 12 and the Industrial Area will contain 38 air injection wells and 20 soil vapor extraction wells that are positioned to have overlapping radii of influence as shown in Figure F-4. Technology vendors indicate that the radius of influence for an air injection well is approximately 1 to 1.5 times the submerged depth of the well [VISITT (IT Corporation), July 1994]. At Site 12 and in the Industrial Area, this radius of influence would be approximately 20 to 30 feet (based on an average submerged depth of 20 feet). For the conceptual layout, the radius of influence for an SVE well was assumed to be 50 feet based on a vendor quote.

Volatilized TCE that is captured by the SVE wells will be sent to an on-site treatment plant where it will undergo carbon absorption treatment. The treatment plant will also contain the necessary air and vacuum blowers and vapor-water separation unit.

Because air sparging and SVE are relatively new and innovative technologies, a field pilot test is recommended prior to initiating the system design. The pilot test will determine the loss of efficiency over time as a result of inorganics precipitation and oxidation on the well screen, the radius of influence of the air injection and SVE wells under various heads of pressure, the rate of off-gas organic contaminant removal via carbon adsorption, and carbon breakthrough times. The field pilot test will also determine the off-gas (i.e., untreated volatilized contaminants) concentrations that can be expected. If these concentrations are low, SVE wells and off-gas treatment may not be necessary and the cost of this alternative will decrease.

Table F-4 presents a cost estimate for the air sparging/SVE alternative. The cost estimate also includes the proposed monitoring plan for surface water, sediment, and groundwater.

<IMG 97181QW>
<IMG 97181QX>
<IMG 97181QY>
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<IMG98181RJ>

MR. BLACK: This is Rich Hoff from Baker Environmental. He's going to give us a pitch on the public meeting, Site 12 - Barracks Road Landfill.

MR. HOFF: Thanks, Tom.

Tonight we're here to present the PRAP for the Site 12 - Barracks Road Landfill. And as part of the public comment period, a meeting is tendered and the public was given the opportunity to go over the Proposed Remedial Action and make comments before the report becomes final.

The public meeting tonight will present a Site 12 overview; a summary of previous investigations; Remedial Investigation results; feasibility study, and evaluation of alternatives; the Proposed Remedial Action Plan, and the modifications that have been made to the Remedial Action decision; and then we'll take any questions that you-all may have.

As a general overview of Site 12, the expanded study area is approximately 92 acres. It's located near the industrial area of Weapons Station, just to the northeast of the industrial area between Barracks Road and Ballard Creek. Site 12 Proper contains three general areas; and those are

Area A, Area B/C, and the Wood/Debris Disposal Area.

The first area we'd like to talk about is Area A. Area A is located in the northeast area of the industrial area: Incinerators that burned dunnage or waste materials from ships; and also open burning was conducted in this Area A, and ash was disposed of in this area.

Area B/C is located adjacent to the access road leading to Area A. It is the furthest to the northeast of any of the areas at Site 12. And in general you have disposal materials, a lot of scrap wood, pilings, banding, containers, et cetera.

The Wood/Debris Disposal Area is somewhat central between Areas A and Areas B/C. It primarily disposed of lumber, wooden pallets, but there are other types of debris that are noticeable throughout the Wood/Debris Disposal Area; metal bandings, I believe rail lines, disposed of rail lines.

And this material, by understanding the site history and talking with people at the Station, and evaluating it visually, appears to have been stacked and pushed back over the ravine and then covered with soil, at least the front part thereof.

There have been several

investigations conducted at Site 12, and at all the sites at Weapons Station Yorktown. They start with the Initial Assessment Study that was conducted in 1984, and Interim RI that was conducted in the time frame of 1986 to 1989.

The Round One Remedial Investigation, which was the first project that Baker undertook under the RI program; Roy F. Weston was the subcontractor that did the field work for it, and the Round One report writing; a Habitat Evaluation that was conducted by Baker in 1994; and the Round Two Remedial Investigation and subsequent investigations running from 1994 through 1996.

We'd like to go over the Round One and the Round Two Investigations tonight, because those data are primarily the data that form the basis of the decision-making at Site 12.

The Round One Investigation was conducted in 1992. They investigated surface soils, subsurface soils, groundwater, surface water, and sediment of Ballard Creek.

As part of the Round One RI, there was no risk assessment performed, but the data was summarized, and we do have some of the analytical data to present on the next few figures.

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This figure I think we've seen before, either at RAB meetings or at V-TAC meetings for Site 12. It presents the organic data and the most pertinent organic constituents that were detected during the Round One Investigation, and the investigation as it pertains to surface soils.

The abbreviation stands for noncarcinogenic and carcinogenic polynuclear aeromatic hydrocarbons, or PAH's, and they've been totaled here, just to cut down on the volume that we would otherwise be presenting on this figure.

As you can use, most of the surface soil samples, and a lot of the investigation centered around the incinerator and the back side of the incinerator, which is considered Area A.

And we have hits of PAH's that range from 10 ppm's of noncarcinogenic PAH's, to as high as roughly 7.9 or 8 ppm carcinogenic PAH's detected in these samples.

This overhead presents the inorganic results. And again, we cut this back. I believe that this overhead was first displayed during a RAB meeting for Site 12, and we were trying to evaluate the inorganic data with respect to the disposed ash at Area A; and we were looking for a fingerprint at

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the time, so this figure focuses on the occurrence of lead and cooper.

And as you can see, we have some fairly high concentrations of lead detected in certain samples, 1200 ppm at 12S12, located on the ravine behind the incinerator. Lead at 678 at 12S10, again behind the incinerator.

This in the groundwater data that we collected during the Round One RI, and the primary constituents detected in the groundwater were volatile organic compounds, trichloroethene, and some of its degradation products, 1-2 DCA, DCE. We see relatively low levels throughout the area. 12GW01 being the highest location where TCE's detected at 55 micrograms per liter.

But this was not unlike a lot of the other sites that we've investigated at Weapons Station Yorktown where you find a little bit of TCE's throughout study areas. And an we evaluated this data, we felt fairly confident that we were in a situation that was similar to those sites that we have previously investigated. This changes as part of the Round Two investigation.

This particular overhead presents the inorganics detected in groundwater, both total

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and dissolved. And the interesting thing to note here is that lead is detected at relatively low levels in the total, but not in the dissolved groundwater samples. And this is important because we saw the lead detected at relatively high levels in the surface soil at Area A, yet the groundwater samples really don't exhibit high concentrations of lead. But you do find the constituents barium, copper, manganese, and zinc, the typical actors that we encounter at Weapons Station Yorktown.

Surface water was also sampled an part of the Round One Investigation, and surface water at Site 12 can be divided into two distinct types: Ballard Creek, which we believe, and the Navy believes, is an established waterway; and intermittent streams that are formed by the ravine and at times do have water, but at timen are dry.

We sampled the intermittent stream coming from the Area A portion of Site 12, and downstream thereof; and Ballard Creek as part of Round One. And you can see that we get relatively low levels of TCE's in locations in Ballard Creek, as well as the intermittent streams.

Inorganics were also analyzed for surface waters, and it's not unusual that we would

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find the same actors. We have lead detected in Area A intermittent stream; a little bit of lead detected in the up-gradient location at 42 milligrams/kilogram, but no real pattern, or discernible pattern, specifically of lead occurring in the creek proper.

So as we evaluate this data, at least as part of the Round One Investigation, it doesn't appear that Area A is a large contributor of lead; at least at this time, to the surface water features, which in Ballard Creek and its intermittent streams.

This overhead presents the results of sediments. Not surprisingly, we see the PAH's in the sediments downstream of Area A in the intermittent streams, and PAH's sporadically throughout Ballard Creek. Relatively low levels. Finally, the inorganics in sediment. Again, you do have the detections of lead, a little bit of mercury in the intermittent stream downgradient of Area A. You also have a little bit of lead occurring in Ballard Creek, but no real discernible, statistically discernible, pattern of contamination. And by that, what would be nice to see, would be -- you know that you have lead in soils

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in Area A; and we know that based on the nature of Site 12, this area is an area that is subject to erosion. We would expect to see then, a trend of lead or some other inorganic constituents as a fingerprint in the ravine and intermittent streams leading to Ballard Creek, and then hopefully downgradient of the confluence of Ballard Creek-and intermittent streams coming from Area A. We would be able to see lead sort of winnowimg its way out along the creek. And again, we really don't get that from the Round One data.

Based on this data, work plans were produced for a Round Two Remedial Investigation. The primary purpose of the Round Two Remedial Investigation was to collect additional data to fill the data gaps to conduct a baseline risk assessment, both human health and an ecological risk assessment for Site 12.

An a result, we collected additional soil samples, groundwater samples, surface water samples, sediment samples, and in this particular investigationt biota. By biota, I mean benthic results from sediment, as well as fish population counts from locations along Ballard Creek Proper. An we're going to go through the figures that

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present the data for Round Two in the same fashion as we did for Round One.

We collected additional surface soil samples, particularly in Area A, because of the high hits of lead. And this figure was put together subsequent to the Round Two Investigation when we confirmed the results of the Round One and observed that lead was detected at levels in the thousands of parts per million in surface soils at certain locations in Area A -- and again, they seem to coincide with the ravine behind the incinerator where we know ash was disposed of.

Some of these data points were also selected -- you'll notice an NA on the figure, this was not analyzed, because what we were doing was filling a data gap for the purpose of the Feasibility Study during this particular phase of the investigation. And in areas where you see NA, the shallows, this location was taken at depth to confirm a surface soil hit of lead that was detected in either the Round One or the Round Two.

You can see the lead in relatively high in certain locations, 12S62, 7,500 ppm, and 9,100 ppm in the two to four foot sample. And this occurs throughout. Exceedences of the 400 milligram

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per kilogram Human Health Action Level derived from the IUBK model, both in the shallow samples, as well as some of the deeper locations.

This particular overhead presents groundwater data for TCE. After the Round One Investigation, and during the Round Two Investigation, we were installing hydropunches, and the hydropunches were being installed to optimize the placement of additional monitoring wells.

When we did this, we ran into a high hit of TCE in an area that was somewhat unexpected, off of the corner of Building 4 and 5 of the industrial area. We had hydropunch hits and groundwater detections of 800 parts per billion of TCE, and its breakdown products, 1-2 dichlorethane were also detected.

This was the first time we really ran into any concentrations this high at a site at Weapons Station, and it sort of surprised us because we were not expecting to find it in that area.

If you remember from the Round One Investigation, we only found it at 55 ppm, and I believe that was at 12GW01, which is located in the northernmost portion of the study area.

We talked to the folks at the

Station and found that there was an underground storage tank that was located off the back side of Building 5, that had been pulled a few years prior to our Round Two Investigation, and there was a monitoring well in place from that investigation.

So we resampled that particular monitoring well, USTMW04, and built off of those results to produce a groundwater monitoring network that you see here. But because we had detected TCE in this area of the study area, we also investigated the central portion of the industrial area where another UST had existed until a few years ago, and we found the same type of situation. We installed hydropunches, got positive results, and then installed wells.

And in this area, we had concentrations as high as 1300 micrograms per liter in groundwater samples. Building out from that, at 12HP18, we have a downgradient hit of 1700 micrograms per liter.

It's interesting when you look at the topography out here and note how the surface falls away-behind the industrial area toward Ballard Creek, and the ravine joins in and forms intermittent streams that feed Ballard Creek. You really get a feel for how the topography plays into the movement of contaminants at this location.

We also had a site screening area that we were investigating simultaneously at Site 12 that had some high hits of TCE in an intermittent stream adjacent to it. And in our search for what might be the source of that TCE, we sampled a seed location in a location northwest of SSA15, and behind the industrial area, downgradient of our TCE plume, where two ravines connect and meet. And it's likely that during rain events and during wet periods, this is probably a fairly substantial area of-run-off. But when we went out and sampled it, it was fairly dry. In fact, we had to reach up under some tree roots and whatever to even collect a sample, so it was a depressed area.

It's somewhat a point of contention between the Navy and the regulatory agencies as to what type of sample that is. Is it a surface water sample or is that a groundwater sample? The Navy contends by the nature of the sample, it's more likely a groundwater sample than it is a surface water sample because it's not really an established water body in this particular area.

Down further where these two

intermittent streams meet, they form a more substantial water body which joins up with Ballard Creek Proper.

But as we were contouring the TCE and groundwater, we saw this particular location fits in very nicely with the contouring of the data that was done for the groundwater samples. And it really fits in nicely with the topography; although this figure doesn't really show it, in that it appears that the former UST that was located between Buildings 3 and 4, released TCE to the groundwater.

And incidentally, when we sampled this particular location, we were looking for what we would call a DNAPL, or the presence of a continuing source of contamination to groundwater. We were doing this by visual observation of the material we were taking from the bore hole, and also screening by HNEW, and we sent a sample off for laboratory analysis, and no TCE and no real DNAPL was observed in the location of the former UST.

Nonetheless, it appears we have two distinct plumes of TCE in the Cornwallis Cave Aquifer at Site 12. Between the Cornwallis Cave Aquifer and the Upper Yorktown Aquifer, there's a Yorktown Confining Unit, which is fairly thick, an area that's twenty feet thicker and geophysical evaluation of that material proves that the conductivity through it is fairly limited.

Subsequently the data for the Yorktown, Upper Yorktown Confining Unit, indicates that no TCE has made its way yet through that particular unit and is currently affecting the underlying aquifer. So the contours you're seeing right here are for the Cornwallis Cave Aquifer.

According to USGS, and looking at the topography, it's very likely that the Cornwallis Cave Aquifer discharges to Ballard Creek in some way along the stretch of Ballard Creek Proper, behind the industrial area, and that could be either through areas of seeping, that are really not observable unless you were to be out there after a rain event and witness the groundwater seeping along an area; and it can also be through these intermittent ditches and ravines.

And that data is supported by this particular seep sample where we have the highest hit, at least to date, of TCE of 3,300 micrograms per liter.

This particular overhead in a compilation of the surface water data in Ballard

Creek and the tributaries in the expanded Site 12 area. At 12SW22, we have no detected concentrations of volatiles in the surface water samples. That's the furthest upgradient location along Ballard Creek.

As you move down Ballard Creek, you see that there are intermittent hits and non-detected both in Ballard Creek and in the intermittent streams. So it appears that the groundwater is likely, in certain areas in the ravines and along Ballard Creek Proper, having TCE migrate and thusly affect the water body.

But again, I'd like to stress that the levels are relatively low, .7J at SW/SD17; relatively low on the back side of Area A after the confluence of the intermittent stream.

The highest detected concentration -- and again, this was what took us down the line to sampling the seep in the vicinity of SSA15, was 15SW10 where we had a hit of 340 micrograms per liter. It's sort of interesting that this particular sample was sampled twice; once I believe in 1995, Dave, during the SSA Investigation?

MR. DAVIS: Late '94.

MR. HOFF: Late '94, early '95; and again in early 1996, and the concentrations were very

similar, 300 to 400 micrograms per liter. The data suggests then that TCE's in this particular seep, or in the groundwater regime on the backside of SSA15 associated with the industrial area, may be seeping to this particular water feature and affecting the water quality; but it's very quickly diluted out by the time it reaches Ballard Creek.

Of the things that were accomplished during the Round Two Remedial Investigation were the geophysical surveys; and more importantly, the human health risk assessments, and the ecological risk assessment.

The geophysical survey was conducted to better define areas, or extent of the former disposal areas. During the Round One Investigation, Weston had done some geophysical interpretation of the waste disposal areas, and they had left hatch lines for us to fill in as part of the Round Two. The geophysics were conducted, therefore, to fill in those hatched areas and give us a better indication of the extent of the site.

The complications with that is that, as you begin to try to define the extent of these sites, and the subareas of Site 12, you very quickly run into the wooded areas; you run into the existence

of roads, fences. These are all features that greatly affect the results of the geophysics. So the geophysics give us some indication of the extent of these areas, but I think a far better indication is using a test pit where you can actually dig into the material and not only determine the extent of the disposed area vertically and horizontally, but also get an idea of the nature of what's in there.

This figure presents the Round Two Interpretated Area of Disposal, and the areas within the larger Area A, Area B/C, and Wood/Debris Disposal Area, indicate those areas where there were higher metallic anomalies detected by the geophysics.

As a result, those locations were specified for sampling; and in most cases, we got one or more samples in each one of those locations that gave us this particular type of anomaly.

The Round One and Round Two data were then compiled; and as a result, a Human Health Risk Assessment was conducted. And we conducted the Human Health Risk Assessment considering the contamination in the soil, the groundwater, surface water and sediment, both current and future potential exposure pathways and receptors were evaluated; and of course, carcinogenic and non-carcinogenic risks were derived for carcinogenic and noncarcinogenic contaminants.

The current potential risk was evaluated by looking at a potential trespasser, somebody who could get through the fence from the park side and get onto the Site 12 study area on a very limited basis. In general, for this particular receptor, the carcinogenic risks and the RCI values for potential derma contact, and accidental ingestion of contaminants in soil, fell within the-USEPA's acceptable target risk range.

Noncarcinogenic risk values, HIs were below one for Area B/C and the Wood/Debris Disposal Area, as were the ICR's within the acceptable target risk range. But noncarcinogenic risk values, or hazardous debris, were slightly above one im Area A, indicating that some type of noncarcinogenic health response could occur subsequent to thin type of exposure.

An evaluation of risk to future potential receptors was also conducted. The most conservative future potential receptor is the future potential resident; someone who is going to build a house on your site; establish a well in the groundwater below the site; and someone who is going to be exposed 365 days a year for a thirty-year lifetime; and we consider both children and adults in this assessment.

The carcinogenic risks obviously were not within the USEPA's target risk range, and this was driven primarily by the presence of TCE and its degradation products in the Cornwallis Cave Aquifer. And again, that's assuming that potable use of the Cornwallis Cave Aquifer is, in fact, going to occur.

We also had HIs in exceedences of 1.0 in Area A, which is not surprising because certainly the less conservative current potential exposure scenario for the trespasser also showed a risk in the area.

MR. THOMPSON: Did the lab present anything for hazards to children in Area A?

MR. HOFF: Yes, we ran the IUBK model for Area A, and it indicated, with some certainty, that this would, in fact, become a problem for a child. I'm not exactly sure what the percentile value was that we derived, but it was up there.

We also looked at the potential for future construction workers to be exposed to contaminants in soils, and the carcinogenic risk for this particular future receptor was within USEPA target risk range, 10 -6 to 10 -4.

Again, you had noncarcinogenic risk values, or HI, that slightly exceeded 1.0, and this was driven by the presence of antimony in subsurface soil. Antimony is similar, in the subsurface at Site 12, to the station-wide background values that we saw, so it is quite possible that the antimony that we're seeing here is associated with natural occurrences of that particular constituent, and not an activity that has been conducted at Site 12.

Again, lead in Area A were above the USEPA action limit of 400 milligram per kilogram, which itself is derived from the IUBK; and if you have several exceedences, if you have statistical interpretation of data that produce mean values or upper confidence level values in excess of 400, it's probably a pretty good bet that your IUBK model will also indicate a risk.

Weapon Station Yorktown being an ecological activity presents us with some interesting problems, and these problems were brought to light an part of the Round Two Ecological Risk Assessment. It was conducted for both aquatic and terrestrial receptors in the area of Site 12; and it considered all areas; Area A, Area B/C, the wood/Debris Disposal Area, and the aquatic obviously considered Ballard Creek and its intermittent streams.

This particular overhead is trying to boil down and make some sense out of data we saw in the sediments. When you evaluate the sediments, a first cut at the Ecological Risk. Assessment is a comparison to screening criteria. In this case effect range low values and effect range median values, and these are values that have been established by toxicity studies, or through a literature search for particular contaminants in sediments that could cause some potential effect if they are exceeded.

We had a lot of exceedences of ER-L's, and it was sort of difficult to make sense of those exceeded,, since they were both upstream and downstream of our particular areas; and ajain, we don't have that fingerprint, per se, that gives you some statistical inference as to which of the areas at Site 12 poses the greatest risk or presents the biggest source of potential contamination to the aquatic environment.

What I did was, I broke the data

down even further in this particular overhead to evaluate where my potential risks were coming from, because we had sediment QI values that were relatively high, I think in excess of 600 when we went to the ER-L, and in excess of 30 when we looked at ER-M's.

It's interesting to note here that the worst of the locations appear to be in the tributaries, particularly at 12SD12, which is downstream from Area A; we have the presence of PAH's, not surprisingly, but we also detected some PCB's in this particular location.

We detected PCB, 1254, 1242 and 1248. This particular figure has a typo on it. The concentrations should read PCB 1242, 530 micrograms per kilogram, and that's J, 48, 340 micrograms per kilogram, that's value J; and 54, 120 microgram per kilogram, and that value should be J.

In Ballard Creek Proper we have an exceedence of ER-M at 12SWO9. This is somewhat upgradient from Site 12, and it gives us an indication that you can have PAH's occurring in the sediments from other sources. PAH's, like sediments, present a very good sink for PAH's. What we notice is that a lot of the exceedences are by inorganics;

and those inorganics are manganese and zinc; and further down, silver begins to pop up. Also cadmium in a few locations.

And as you evaluate this overhead, what I'd like to do later on is I'll draw in some of the physical characteristics of the sediments that sort of play into the erosional nature of Ballard Creek, and they give us some insight as to why these data might tell us what they do.

But I think from an overall perspective, when you break down the sediment QI value, constituents such as the PCB's, which are likely site related, and I believe they're related to Area A; but the pesticides, DDD, alpha-chlordane and gamma-chlordane, these are big contributors. And the pesticides are likely due -- their occurrence is likely due to past applications. We don't see DDT. It's interesting that we see DDD, but we don't see DDE or DDT.

To recap some of the ecological risks that we saw at the site, when we took a look at the benthic data, the average Site 12 density of benthics was several times higher than the average background density. One of the most important things at Weapons Station is, when you take a sediment sample and you take a benthic, it's important to have, obviously, a reference station or sediment value that you can compare and make some sense of your data.

In this case, the density was higher, and MBI's for Site 12 ranged from excellent -- this is upstream -- to 9.19, which is a poor water quality indicator downstream of the areas.

Again, from a ccmparison standpoint, MBI's, from a background standpoint, range from 4.3, excellent; to about 7.6, indicating fair water quality. So we do have suggestion of some impact to the benthics and to the sediments at Site 12.

At Site 12, the diversity of benthics was lower than the average diversity calculated for background, meaning that the numbers of benthics macroinvertebrates that we saw, in terms of the families, were different from those we have seen at background locations.

In general, other stressors could be impacting these benthics. And other stressors may be erosion, because of the nature of Site 12 and Ballard Creek in particular. You do have a lot of erosion occurring, and we'll show you some data that may support that.

This overhead presents a breakdown of the MBI. It's a density of the benthics and the number of TACSA that were identified per station. You can see we have our best water quality occurring at 12BM09, which is the furthest upstream location, but there's really no statistical degradation from that point on. We have some 8's, some 7's at 12BM19; again, indicating poor water quality.

We also have the same situation occurring in the intermittent streams downgradient of Area A, and on the back side of the Wood/Debris Disposal Area. But the interesting thing to note is that the number of TACSA does go up as you move down Ballard Creek; and this is really independent of the Site 12 area proper.

The other stressors that we were speaking of, and the potential for erosion to affect these results, can be evaluated on this particular overhead.

Benthics living in sediments are very dependent upon their environment; and that environment is usually evaluated by grain size analysis, and it gives us an indication that when we look at the benthic results, and we look at MBI's, are we looking, at the same type of environment physically; not just from a chemical standpoint, but from a physical standpoint as we go up and down a particular stretch.

In this case, it appears that your greatest percentage of fine sands occur at 12SDO9 where we saw the best water quality. And as you move down Ballard Creek, you can see that your fine sands decrease somewhat, and you have an increase in your medium sands, and even your coarse sands,

For instance, at SD17, we have fine sand at only five percent, your medium sands are 25, your coarse sands at 44; and also your percent silt and clay picks up an well. There's really no good statistical way of evaluating this, because you're not going to get a trend if you try to take a station location and move downstream past the study area; but what it tells me is that with all the erosion you have in the intermittent ditch or intermittent streams, and the other erosion in general to the Ballard Creek water shed, you have the fine sand winnowing out, and the erosion contributing more medium and coarse sands to the creek proper. And by the time you get down to 12SD21, which is the furthest downstream location, it almost represents an area of well-mixed -- or a well-mixed area, in that you have about 20 percent fine sands; about 40 percent medium sands, 25 percent coarse sands, and almost a representative fraction of silt and clay. So this could also have some effect on the benthic results, in addition to any type of chemical impact that we might see.

We're jumping around here a little bit, but going back to the Ecological Risk Assessment, the terrestrial component in particular, we run terrestrial uptake models to determine what a receptor might be exposed to through the course of moving across the study area and their feeding and living therein. These uptake models consider the uptakes associated with plants that may bioaccumulate contaminants, incidental ingestion of dust while the animal was eating; but there's also a water components to this model. And in this instance, we used Ballard Creek as the water source for the terrestrial receptors at each one of the locations: Area A, Area B/C, and the Wood/Debris Disposal Area.

The terrestrial receptors that were evaluated were taken from our habitat evaluation studY; and we found evidence of Red Fox, Bobwhite Quail, Eastern Cottontail, Raccoon, White-tail Deer, or some similar animal at Site 12.

As with the sediments, your first cut is always your comparison to screening values, and our first cut told us that Area A had exceedences of flora and fauna toxicity values for PAH's, PCB's, limited nitramines or explosive compounds, and inorganics at Area A. We also had exceedences for PAH's and inorganics at Area B/C; and in the Wood/Debris Disposal Area exceedences, for PAH's.

When we ran the uptake model, the primary drivers or constituents that contributed to the majority of the risk in-Area A were the inorganic barium, cadmium, iron, and selenium and 1,3,5 TMB. Now, 1,3,5 TMB was only located in a few locations, or soil locations; but nonetheless, it has a fairly low reference value, toxicity value.

And that's typically what you do with an uptake model: You evaluate what's in the soil, what can be uptaken by the plant, and then what the animal will collect an a body burden. That body burden can then be compared to some reference toxicity data.

This overhead breaks out soils and the soil/water fractions of the model. And the reason we did this was to make the point that Area A is really the primary area of concern from an ecological standpoint, as well as human health, because when you look at the contribution to the model from a soil standpoint, and from a soil/water standpoint, you can see that most of our terrestrial receptors, the Raccoon, the White-tail deer, the Cottontail and the Shrew, has an elevated value, an elevated quotient index.

As you make the distinction in Area B/C and the Wood/Debris Disposal Area, you see that only the Raccoon and the Short-Tail Shrew, show exceedences. There's a reason for the Short-Tail Shrew showing the exceedence, and that has to do with the how the Short-Tail Shrew gets its sustenance.

We assume that the Short-Tail Shrew eats worms, and there is really no good biological concentration factor data out there to determine how a worm uptakes contaminants from soil, so in essence a worm to a Shrew, in these uptake models, is a dirt sausage; and as a result, the Short Tail Shrew pretty much shown an elevated QI everywhere, even for background.

The Raccoon shows a high quotient index to the soil and water fraction, partly because of the presence of cadmium in surface water; and we do have a BCF value for cadmium in surface water. As we all know, Raccoons eat fish. If we assume that 60 percent of the Raccoon diet is taken from fish taken from Ballard Creek. Because of the presence of cadmium in Ballard Creek, and at a few locations, when you run the model to determine what the body burden of the fish would be that the Raccoon is going to eat, you get these high values. And what we wanted to show here is that they're independent of the soil concentrations.

So we believe that there's really no significant ecological effect occurring in either Area B/C or the Wood/Debris Disposal Area from the soils therein; that when you got the elevated quotient index, it's because of the water component and not because of the soil.

At this time I'm going to turn to the floor over to Tamy Halapin, and she's going to run you through the FS and PRAP, and tell you what our Proposed Remedial Action is for Site 12.

MS. HALAPIN: Hi. Basically, the FS took all the information that the Round One and Round Two RI compiled; a lot of information there, and it's been a continual change in growth with the FS Evaluation also. The Feasibility Study is basically based on the results of the human health and ecological risk assessments.

The purpose of the FS was to identify potential remedial action alternatives for Site 12, and basically the PRAP, or the Proposed Remedial Action Plan, separated the media into two operable units at Site 12. We wanted to focus on Area A soil; and we wanted to focus on everything else separately.

So Operable Unit III, as it's distinguished in the PRAP right now, is the soil in area A, and Operable Unit IV is, as it stands, soil in Area B/C, the Wood/Debris Disposal Area, the groundwater and surface water and sediment at Ballard Creek. The Remedial Action Objectives were developed for Operable Unit III, and basically they were to prevent erosion from Area A; develop an alternative that would meet that. Prevent direct potential contact with the lead contaminated soils, by either human or/and ecological receptors; and to remediate the soil to meet the remediation level of 400 micrograms per kilogram. This is based on the EPA action level.

And also the Remedial Action Objective for Operable Unit IV, the remaining media at Site 12, was to insure that the quality of the groundwatert both shallow and deep, and that the surface water and sediment at Ballard Creek did not deteriorate over time.

So based on those Remedial Action Objectives, the FS determined and evaluated several different alternatives. And for Operable Unit III in particular, there were 6 RAA's developed, and they range from the no action alternative, which is always used as a baseline for comparison.

The next alternativet RAA 2, included institutional control; such as, land restrictions, deed restrictions, monitoring, involving surface water monitoring at Area A, and erosion control measures to try to prevent the further erosion at Area A.

Remedial Alternative 3 was a soil and clay cover to be placed on the lead contaminated soils at Area A.

Remedial Action Alternative 4 was to excavate the lead contaminated soil and landfill it off site.

Number 5 was an innovative idea to in-place solidify the lead contaminated soil by adding a cement-type mixture forming a solid mass and then capping over that with soil and clay cover.

And Alternative 6 was a treatment alternative of excavating the ash in the soil and soil washing and leaching it on site and replacing the treated soil.

Basically we will go over some of the main components of each of these alternatives. As I said, the no action would be nothing would be done at the site, it would remain as-is. This is just a baseline alternative that's included in every FS just to use for comparative purposes.

The net present value: The FS calculates a net present value for every alternative it evaluates, and the no action obviously is zero.

Remedial Action 2 was the institutional controls with the soil, surface water monitoring, and erosion control. That has a Net Present Value estimated at $670,000. It would be, like I said, deed restrictions and land restrictions, and putting rip rap along the stream channel leading from Area A down Ballard Creek.

Number three is a soil and clay cover, which would be placed over a foot of clay and the topsoil placed -- I think that's what we wrote in the FS, but placed over the lead contaminated area, any place exceeding 400 micrograms per kilogram, and would also include a lot of erosional control measures in the remaining areas that weren't above that level, just to prevent the erosion so it meets the one objective. It would also include the same long-term monitoring program as Remedial Action 2, the surface water monitoring, the same institutional controls. The Net Present Value for this one was estimated at one million dollars.

For Number 4, the Offsite Landfill Disposal, basically to excavate the soil that exceeded the action level, had the same monitoring program, institutional controls and also the erosion control measures, it was estimated at 4.8 million dollars.

Number 5, the In Situ Soil Stabilization/Solidification Alternative would be to in-place mix the soil with the cement. It would have a soil clay cover on-top of the treated mass, and again, it would have the same monitoring program and institutional controls and erosion. It was estimated at 1.4 million dollars.

And finally Alternative 6 would be to excavate the soil that exceeded the level, run it through on-site treatment system consisting of soil washing and soil leaching, and again apply the same other monitoring and erosion controls. It was estimated at 2.9 million dollars.

So the purpose of the FS was to go through and evaluate -- develop these alternatives and evaluate them. At that step, the Navy prepared a Proposed Remedial Action Plan of what they want their remedy to be for the site, and that's basically the purpose of tonight's meeting.

The Navy has preferred the Alternative Number 3, the soil cap and clay cover for Operable Unit III; and for Operable Unit IV, it is as it's presented in the PRAP, for long-term monitoring of the soil, of the surface water, sediment, and groundwater. And the details of this monitoring will be determined and developed and agreed to by all the parties in a separate document that will be part of the Long-term Monitoring Work Plan.

MR. THOMPSON: Rich, at this point I have a question.

MR. HOFF: Sure.

MR. THOMPSON: I notice a lot of the alternatives that are being evaluated are based on the lead 400 level. There were some other metals that were indicated an being risk drivers. Is there any other evaluation done for those other metals?

MR. HOFF: We didn't do an evaluation of clean-up levels for other metals, but we did get that comment from the EPA, and the basis of the comment was that when we proposed an area that was to fall under the cover, they wanted that area extended to also include two or three locations where I think we had risks; and these were risks, I think, primarily to the terrestrial receptor to cadmium and some of the other inorganics. And what we did was, rather-than screen values for the ecological, we simply extended the cap to include those areas as well.

MR. THOMPSON: So there will be some sort of criteria for extending that cap? In other words, sample soil, and if you get cadmium at a certain level, the cap will extend?

MR. HOFF: Yes, we'll make that determination in the Final Record of Decision.

MR. THOMPSON: In that going to cause the cost to increase significantly?

MR. HOFF: Not substantially. I think that when you do the cost, and Tammi would probably agree with me, for FS purposes, by the time this goes to the RAB contractor, those numbers are pretty much cartoons to begin with. But the areas that it extends to are relatively close in boundaries as, we've described earlier in the FS, and then later in the PRAP, so I wouldn't expect that it would substantially increase the cost.

MR. THOMPSON: It will help in the Final ROD to close that loop. In other words, present the risks up front. Here's the organic, here's the risks. Present the risks. You don't really discuss that in the selection of the alternative.

MR. HOFF: Yeah, There's a number of things we need to do in the final ROD, and what we're going to try to do is issue an Interim Final to all parties so we can get the blessing,, not only from the State, but also from RAB, and most importantly, you legal folks.

And as Tammi goes through here, her next overhead in going to present the proposed action and the operable units that have broken out based on a lot of the comments and back and forth between the Navy and the agencies.

MS. HALAPIN: Basically, just to show a display of the proposed alternatives, it's this portion here, that's the hatch area, would be the soil/clay cover for the approximate boundaries.

As Rich did say, this area right in here was extended to meet one of the comments.

MR. HOFF: Yeah, I think we brought it out in --

MS. HALAPIN: That is extended already.

MR. HOFF: Yeah, it extends towards -- along these lines where we just moved the boundary out to include those locations, but we'll make sure that's presented in the final.

MS. HALAPIN: Then the other area, the shaded area, is where, in general, the erosion controls measures would be installed and in place, basically behind the incinerator and along the stream channel. That's a real conceptual model of what the actual alternative would consist of.

The rational for the remedy that's been selected for OU III is that basically it provides the most appropriate and cost effective level of protection that the Navy considers that should be appropriate for the nature of the contamination that's there. Also the cap, you definitely want, as long an it's maintained adequately, will provide a physical barrier to lead contaminated soil. That's our main concern, the dermal contact and trespassers having access and contact with it. And the cover will effectively isolate the soil if it is adequately maintained.

The rationale for selection of the remedy for OU IV is that basically the groundwater will not be remediated under this. The TCE levels detected in the groundwater did not exceed the remediation levels that were determined in the Feasibility Study. In addition to that, the geology, the hydra-geology of Site 12 is very complicated. There are solution channels that are very common in shallow aquifers, and erosion, and it's something that would make it technically very difficult to install and implement a typical pump-and-treat-type of groundwater treatment system, or something similar to that, so there's also other types of limitations that would come into play with the groundwater.

With respect to the sediments, again, they're not going to be remediated under this alternative. Basically the treatment of the sediments require the dredging of Ballard Creek and/or the tributaries, and sometimes, most of the times, it has more of a significant impact to the ecological environment than by leaving things as they are. And in addition to that, there are no enforceable remediation levels at this time for sediments to be considered protective of the environment.

For the PRAP itself, the public is encouraged to participate in the decision-making process. The PRAP is the Navy's selected remedy right now, but the actual remedy can change, and what's presented in the ROD is based on input from agencies and the public.

Any written comments can be forwarded to Mr. Tom Black, who is here, and at the address that's on the slide. And comments will be accepted until the end of the public comment period, which is August 14th, 1996.

Since the submission of the Final PRAP in June, there's been a lot of discussion between the Navy and the agencies and the receipt of different comments, and there have been -- the Navy has considered some modifications already that will result in the Record of Decision, and these modifications are not final yet. Again, they will be determined once all the comments are received and the public comment period is over.

But just to give you a brief of idea of what some of them are, right now we're determining that the ROD now will be separated into these Operable Units. Operable Unit III will stay the same, the soil in Area A. Operable Unit IV, will only include the soil in Area B/C and the Wood/Debris Disposal Area; and Operable Unit V will include the groundwater, surface, sediment in Ballard Creek.

And then to go along with that, the remedy that will be presented will be the same thing for Operable Unit III, RAA-3, the soil and clay cover, and it will include long-term monitoring as per the NCP, meaning that every five years the surface water will be monitored. Every five years a review of that data will be evaluated, and that will be long-term, indefinitely.

OU IV will be -- and that is for the soil in Areas B/C, and the Wood/Debris Disposal Area, that will be no action with institutional controls, basically land restrictions, deed restrictions.

OU V, which in the groundwater, surface water sediment, will have no action with long-term monitoring, as per the NCP, and institutional controls, and sediment monitoring as agreed to by the parties, which means it won't be locked into the every five years review, but just evaluate if the sediment quality is being still

affected. We'll definitely have something we can
Agree to what type of monitoring schedule.
That's basically to-date what's been developed for Site 12, and what the Navy -- where the Navy is heading with it. But again, there's still plenty of time yet for additional comments, and we'll see from that. Thanks.
And I quess questions and answers will be next.
MR. DEWING: Has there been any input from the National Park Service on any of this?
MR. BLACK: Yes, we have received comments from the National Park Service on the PRAP with the two Operable Units, and the Park Service has reiterated it's desire to see additional data collected for Ballard Creek, the surface and sediments therein, but they did not seem to be in disagreement with the selection, the remedy, or the break down of the Operable Units.
The reason for the changes to the Operable Units are -- there are several. One is you have potential for adverse ecological effects occurring in sediments; is that from groundwater infiltration of Ballard Creek? Is that from erosion? Is that from physical stressors that may be present

that we talked about in the sediments?

What we hope to do through this particular break-out is consider the Department of the Interior, the Parks, and their desire to see additional data collected for the ecological, particularly Ballard Creek; but also make sure that ROD's legal folks are happy with the way that we are specifying the long-term monitoring, because it's very difficult, I think, under -- in fact, I think as we get into this more and more, the only way I see we can agree to long-term monitoring under the NCP, is if we leave a waste in place. And I guess by saying "a waste in place", that would be anything that would be residual before, during, or after some treatment, or under a no action scenario.

MR. THOMPSON: It's when you leave a waste in place, such that the land use or the use of that area is restricted to some degree, so that every five years you review data and determine whether or not that restriction still needs to be in place.

MR. HOFF: Before we didn't really make the distinguishment about how we were going to monitor. There was some verbiage in the PRAP that described that we would, among the parties, decide upon a long-term monitoring plan, that would be a primary document under the FA. That doesn't really give the legal folks, ROD's legal folks, the closure that they need to say, We will sign on this Record of Decision; but by doing this, we hope to establish the fact that the data is equivocal in indicating Area A is probably the biggest culprit of human health and ecological risk perspective at Site 12. But we also acknowledge the fact we are leaving TCE in groundwater above MCL, but below clean-up goals that were developed for beneficial use.

The reason we did that is we believe the groundwater in that area will not be used for public purposes. It's not currently, and we don't believe it could be in the future. But we are lucky in that we do have the Yorktown Confining Unit that has kept this TCE from migrating to the Yorktown Aquifer, which itself In not used for public purposes in the vicinity of the station, but it's certainly --

MR. DEWING: What did you say was not used?

MR. HOFF: The upper Yorktown.

MR. DEWING: The Yorktown Eastover Aquifer?

MR. HOFF: There are some distinguishments about the Yorktown Eastover. It's a fairly large aquifer.

MR. DEWING: Yes, I know.

MR. HOFF: What we're saying is, the Upper Yorktown Eastover, in the vicinity of Site 12 is not used as potable.

MR. DEWING: Okay. Because my well goes into the Yorktown Eastover.

MR. HOFF: Right. I think we talked about that here before.

MR. DEWING: Yes.

MR. HOFF: I know Allen Brockman has a lot of good data.

MR. DEWING: I've seen it.

MR. HOFF: And it's interesting, Allen has really provided us with a lot of good insight on the groundwater in the region of Weapons Station Yorktown. And when Allen first got involved, the question was, would these sediments qualify, and I think at first my reaction was, being a consultant to -- an environmental consultant, if it's wet, we have to evaluate it as an aquifer. He's come up with some very interesting data that suggests that in certain portions of these aquifers, even though you're seeing what we may not consider to be a confining unit -- when we say a confining unit, we're talking about a nice, thick, dry clay that shows distinguishment between aquifers. He is indicating that there are formations that can grade out to the extent where you just do not have any water movement. They might be wet, but they are, in essence, acting as a barrier. It's sort of a good news, bad news, good news; or it's a bad news, good news, bad news situation; however you want to look at goundwater at Site 12.

I think the data indicates that the former source was the industrial area and the UST's. we have a good handle on both of the plumes and the direction they're headed.

The bad news is that they discharge to Ballard Creek, and we're seeing that at relatively low levels; not above any State criteria and certainly not above any of the Federal criteria. The good news is that they're not making it, at least in this area of Yorktown.

MR. MARTIN: I guess the note I wanted to make was, Rich Strycker, who was going to do the question and answers, he called me this morning and he's got a second child apparently on the way, so he had to go to the hospital with his wife. That's why he's not here tonight, and I guess with that, you can close or I can close it.

We appreciate everybody coming and we'll see you at the next public meeting. Thank you.